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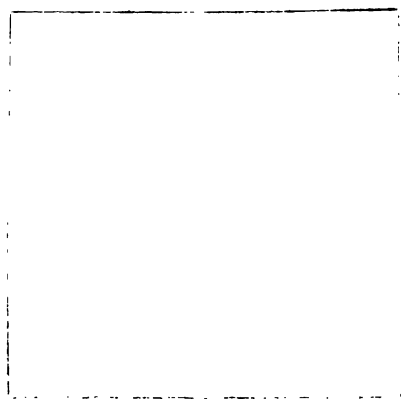
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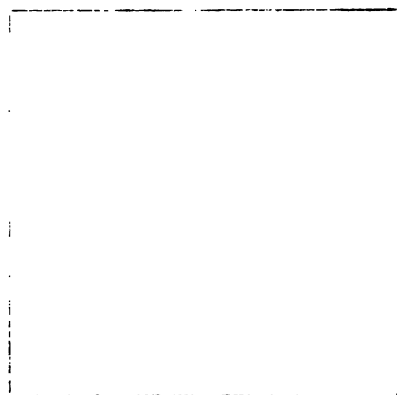
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1891

УВАЖАЉИ ОБОЖАТЕ

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UNITED STATES GEOLOGICAL SURVEY

J. W. POWELL, DIRECTOR

THE

MINERALS OF NORTH CAROLINA

BY

FREDERICK AUGUSTUS GENTH



WASHINGTON
GOVERNMENT PRINTING OFFICE
1891

CONTENTS.

	Page.
Letter of transmittal.....	9
Preface	11
Native elements	13
Gold.....	13
Silver	14
Platinum	14
Palladium	14
Copper	14
Iron, including meteorites	14
Lead	20
Antimony	20
Sulphur	21
Diamond	21
Graphite	22
Sulphides, etc.....	22
Sulphides and tellurides of metals of the sulphur and arsenic groups.....	22
Stibnite	22
Bismuthinite	22
Tetradymite	22
Molybdenite	23
Sulphides, etc., of the iron, gold, and tin groups	23
Argentite.....	23
Galenite	23
Altaite	23
Bornite	23
Sphalerite or zinc blende.....	24
Chalcocite.....	24
Troilite	24
Pyrrhotite	24
Schreibersite	24
Pyrite	24
Chalcopyrite	25
Barnhardtite	25
Marcasite	26
Leucopyrite	26
Arsenopyrite.....	26
Nagyagite	26
Covellite	27
Sulpharsenides, sulphantimonides, etc.....	27
Proustite	27
Aikinite	27
Tetrahedrite.....	27

	Page
Compounds of chlorine, etc.....	28
Halite	28
Cerargyrite	28
Ferrous chloride	28
Fluorine compounds	28
Fluorite	28
Yttrocerite	28
Oxygen compounds	28
Oxides	28
Cuprite.....	28
Melakonite	29
Corundum	29
Hematite	31
Menaccanite	31
Spinel	32
Gahnite	33
Magnetite	33
Chromite	34
Cassiterite.....	35
Uraninite	35
Rutile	36
Anatase	37
Brookite.....	37
Pyrolusite	37
Braunite.....	38
Hausmannite	38
Diaspore.....	38
Göthite.....	38
Limonite	38
Gummite	38
Psilomelane.....	39
Wad	39
Senarmontite or valentinite	40
Bismite.....	40
Molybdite	40
Quartz	40
Opal.....	42
Ternary oxygen compounds—silicates	42
Anhydrous silicates	42
Enstatite.....	42
Pyroxene	43
Spodumene	43
Amphibole.....	44
Smaragdite	45
Arfvedsonite.....	45
Crocidolite	46
Beryl.....	46
Chrysolite	47
Garnet	48
Zircon.....	49
Vesuvianite	49
Epidote	50
Allanite	50
Zoisite	51
Phlogopite.....	52

Oxygen compounds—Continued.

Page.

Ternary oxygen compounds—silicates—Continued.

Anhydrous silicates—Continued.

Biotite	52
Muscovite	52
Labradorite	54
Andesite	55
Oligoclase	55
Albite	56
Orthoclase	56
Tourmaline	57
Fibrolite	58
Cyanite	58
Tepaz	59
Euclase	59
Titanite	60
Staurolite	60

Hydrous silicates

Chrysocolla	60
Calamine	61
Talc	61
Pyrophyllite	62
Stilpnomelane	62
Glauconite	62
Serpentine	62
Deweylite	63
Cerolite	63
Genthite	63
Kaolinite	63
Saponite	64
Halloysite	64
Pinite	64
Paragonite	64
Hisingerite	64
Culsageeite	65
Kerrite	65
Maconite	66
Lucasite	66
Penninite	66
Prochlorite and chlorite	67
Chloritoid	68
Willcoxite	68
Margarite	69
Dudleyite	69
Uranotil	70
Thorite	70
Auerlite	70
Xanthitane	71

Tantalates, columbates

Pyrochlore or microlite	71
Hatchettolite	72
Tantalite	72
Columbite	72
Yttrotantalite	73
Samarskite	73

Oxygen compounds—Continued.	Page.
Tantalates, columbates—Continued.	
Rutherfordite	74
Fergusonite	74
Polycrase	75
Rogersite	75
Phosphates, arsenates, etc.	76
Xenotime	76
Apatite	76
Pyromorphite	77
Monazite	77
Vivianite	78
Olivenite	78
Pseudomalachite	78
Lazulite	78
Scorodite	79
Wavellite	79
Pharmacosiderite	79
Dufrenite	79
Phosphuranylite	79
Autunite	79
Niter	79
Tungstates, molybdates, etc.	80
Wolframite	80
Rhombic tungstate of lime	80
Scheelite	80
Cuproscheelite	80
Stolzite	80
Sulphates, chromates, etc.	81
Barite	81
Anglesite	81
Crocoite	81
Melanterite	81
Goslarite	81
Chalcanthite	81
Alunogen	82
Misy	82
Montanite	82
Carbonates	82
Calcite	82
Dolomite	83
Magnesite	83
Siderite	83
Rhodochrosite	84
Cerussite	84
Malachite	84
Azurite	84
Bismutite	84
Mineral coal	85
Anthracite	85
Bituminous coal	85
Lignite	85
Organic compounds	85
Amber	85
Synopsis of minerals and mineral localities by counties.	86
<i>Index</i>	117

LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
DIVISION OF CHEMISTRY,
Washington, D. C., July 31, 1890.

SIR: I have the honor to transmit herewith the manuscript of a report by Prof. F. A. Genth, of Philadelphia, upon the minerals of North Carolina. I request that it may be published as a bulletin of the U. S. Geological Survey.

Very respectfully,

F. W. CLARKE,
Chief Chemist.

Hon. J. W. POWELL,
Director.

PREFACE.

The present bulletin is essentially a new edition, revised, corrected, and much enlarged, of a report published by the Geological Survey of North Carolina in 1881¹. Since that time there has been great activity in developing the mineral resources of the State; and by the reopening of old localities and the discovery of new deposits, a goodly number of species have been added to the old lists. To mineralogists North Carolina has become classic ground, especially as regards the mines of mica and corundum; the localities for modified quartz; the gold sands of Burke, McDowell, and Rutherford Counties; and the emerald and hiddenite discoveries. Minerals formerly supposed to be rare are now found abundantly, and through the recent developments of chemical industry even such unusual species as samarskite, monazite, and zircon have acquired commercial importance. For example, in response to an industrial demand, North Carolina has supplied zircon and monazite by the ton, and samarskite by the hundredweight; and the output can be increased almost indefinitely. The State has also contributed to science several new species as yet not found elsewhere, and some of these, notably among the vermiculites, are significant for the light which they shed upon other associated minerals.

In the former edition of this report due credit was given to several industrious workers whose enthusiasm had done much for the completeness of the record. The late Prof. J. T. Humphreys, and Dr. O. L. Hunter, Mr. J. A. D. Stephenson, and Mr. G. B. Hanna were there especially named. Mr. William Earl Hidden, of Newark, New Jersey, was also mentioned, but since then his continued labors have added largely to our knowledge of the mineralogy of the State. Mr. G. F. Kunz, also, in a number of separate papers and in his large work upon "The Gems and Precious Stones of North America," has done excellent service to the mineralogy of North Carolina. To Prof. J. A. Holmes, of Chapel Hill, ~~much~~ much credit is also due, particularly for perfecting the list of localities.

¹In an earlier form it appeared in 1871 as Appendix C of W. C. Kerr's report. A new edition was printed in 1875 as chap. I of vol. II of the Geology of North Carolina.

In the present memoir there will be found many new analyses, the greater number having been made by the author or under his direct supervision. Several very important analyses, however, were furnished by the chemists of the United States Geological Survey. To the field geologist or the collector of minerals the table of localities at the end of the report will be of especial value.

THE MINERALS OF NORTH CAROLINA.

BY FREDERICK A. GENTH.

NATIVE ELEMENTS.

GOLD.

Gold occurs in numerous localities throughout the State, generally in quartz veins of gneissic, granitic, and dioritic rocks, also in those of talcose, chloritic, and argillaceous slates, and in beds of the slates themselves, and in gravel deposits, the débris of the decomposed rocks and veins. The principal counties in which it has been found in sufficient quantity for exploitation are Franklin, Nash, Granville, Alamance, Chatham, Moore, Guilford, Davidson, Randolph, Montgomery, Stanly, Union, Cabarrus, Rowan, Mecklenburgh, Lincoln, Gaston, Catawba, Caldwell, Burke, McDowell, Rutherford, Polk, Cleveland, Cherokee, Jackson, Transylvania, and Watauga.

It is generally more or less alloyed with silver, varying from pure gold on the one side to pure silver on the other. Near the surface it is usually associated with limonite and at a greater depth of the deposits with pyrite, chalcopyrite, galenite, zinc blende, tetradymite, arsenopyrite, rarely with altaite and nagyagite. Specimens of gold, remarkable for their size, have been found at the Reid mine in Cabarrus County, the Crump mine and the Swift Island mine in Montgomery County (at the latter place in plates, covered with octahedral crystals), at the Causler & Shuford mine in Gaston County, the Little John mine in Caldwell County, and Pax Hill in Burke County. Very beautiful arborescent gold has been obtained from the Shemwell vein in Rutherford County. The variety "electrum," containing from 36 to 40 per cent of silver, has been met with in octahedral crystals at Ward's mine, in Davidson County; also, in Union County, at the Pewter mine, and associated with galenite and zinc blende at the Stewart and Lemmond mines, and in the neighborhood of Gold Hill, Rowan County.

According to the late Dr. Asbury, very interesting specimens have been found at Silver Hill, when the mine was first opened, consisting of lumps of several inches in length, one end of which was pure gold, while the other was pure silver. None of them have been preserved,

SILVER.

Silver is, on the whole, rare in North Carolina. It has been obtained in considerable quantities at Silver Hill, in its native state, foliated and in plates in cerussite, also associated with argentite, gale-nite and zinc blende in small lumps, and arborescent and filiform masses; it has also been found in small plates and reticulated masses, associated with tetrahedrite and zinc blende, at the McMakin mine, in Cabarrus County; two specimens of laminated silver have been observed by Dr. Asbury at the Asbury mine, in Gaston County; it has also been found by Hon. O. J. Cowles, of the Charlotte Assay Office, associated with chalcocite, at Gap Creek mine, Ashe County, and rarely with the gold ores of Scott's Hill, Burke County.

PLATINUM.

The occurrence of grains of platinum among the sands of the gold-washings of Rutherford and Burke Counties was first brought to notice by General Clingman, who sent half a dozen grains from a mine near Jeanestown to Prof. C. U. Shepard. It has also been found on Brown Mountain, in Burke, northwest of Morganton, on Gen. R. F. Hoke's land. It is reported as having been found near Burnsville, Yancey County. Hidden, after much searching, failed to discover platinum at any of the reported localities.

PALLADIUM.

General Clingman sent a specimen to Prof. C. U. Shepard, which came probably from Burke or Rutherford County, which the latter pronounced "native palladium." Very doubtful.

COPPER.

Copper is found in small quantities in several mines, principally near the surface, in minute distorted crystals with limonite at the McCulloch mine, in Guilford County; arborescent and in crystalline plates at the Union Copper mine, in Cabarrus County, near Gold Hill. One lump of copper, about two inches in size, much resembling that from the Cliff mine, Lake Superior, said to have been found in Stokes County, is in the museum at Raleigh. It also occurs in quartz and epidote rock at Harris Mountain, one half mile east of Gillis mine, Person County, at Wolf Creek mine, Jackson County, and Ore Knob, Ashe County. A very interesting association is that of native copper in quartz crystals from lower Mecklenburg County, as observed by Mr. E. Bissell.

IRON.

Terrestrial native iron has been found by Mr. W. F. Page associated with monazite, zircon, etc., in the auriferous gravel of Burke County. It was in the form of small malleable grains of almost pure iron, with mere traces of cobalt. Apart from this, a great number of highly in-

teresting meteoric masses have been found in the State. Many of them have been preserved through the industrious perseverance of Gen. Olingman, and were described by Prof. Shepard. The meteorites found were both irons and stones. They are:

1. The Caswell County iron, which fell on January 30, 1810; it weighed 3 pounds, and was described by Madison.

2. The Guilford County iron was found in 1820; weighed 28 pounds, and was described by C. U. Shepard in 1841. Analysis gave:

Iron	92.750
Nickel	3.145
Iron sulphide	0.750

3. The Randolph County iron was found in 1822, and weighed about 2 pounds. It was described by C. U. Shepard. It is highly crystalline, distinctly foliated, and presents thin, much interlaced laminæ. When polished and etched it shows very fine almost invisible feathery lines, much resembling hoar frost on a window pane. It is, according to Shepard, pure iron with cobalt only in traces. It has a hardness like the best tempered steel, and a sp. gr. 7.618.

4. The Black Mountain iron, from the head of the Swannanoa River, 15 miles east of Asheville. It weighed 21 ounces and is evidently a fragment from a larger mass. It is highly crystalline, laminated, the laminæ being about one-tenth of an inch in thickness and arranged parallel to octahedral planes. Sulphide of iron being inclosed between the laminæ renders it subject to rapid weathering. The analysis by C. U. Shepard gave:

Iron.....	96.04
Nickel, with trace of cobalt.....	2.52
Insoluble sulphur and loss	1.44
Sp. gr., 7.261.	

It was discovered in 1835.

5. The Asheville iron, discovered in 1839 on Col. Baird's plantation, near the French Broad River, 6 miles north of Asheville. It weighed about 30 pounds. Analysis by C. U. Shepard:

Iron	96.5
Nickel	2.6
Silicon	0.5
Chlorine	0.2
	99.8

With traces of chromium, sulphur, cobalt, and arsenic.

6. The Buncombe County iron, found in 1845 and described by C. U. Shepard in 1846, weighed about 27 pounds.

7. The Hominy Creek iron, near the base of Pisgah Mountain, 10 miles west of Asheville. It weighed between 5 and 6 pounds. It is vesicular near the surface, and is said to contain chrysolite, and becomes more compact towards the central portion. The polished and etched portions of the compact meteorite show most delicate Widmannstätten

figures, consisting of very minute and thickly interspersed triangles. Sp. gr. 7.32. The analysis by Clark gave:

Iron.....	93.225
Nickel (cobalt).....	0.236
Iron, nickel, phosphorus, and graphite	4.765
Copper and tin.....	0.099
Sulphur.....	0.543
Silicon.....	0.501
Magnesium, manganese.....	traces.
	99.369

8. The Madison County iron, from Jewel Hill. Several masses have been found. One of 8 pounds 13 ounces, described by J. L. Smith, was presented to him by Hon. T. L. Olingman, in 1854. It was covered with thick rust, and it deliquesces on account of the presence of ferrous chloride. The etched surface shows the most beautiful fine Widmannstädtian figures.

The analysis by Smith gave:

Iron	91.12
Nickel	7.82
Cobalt	0.43
Phosphorus	0.08
Copper	trace.
	99.45

Another mass, which weighed about 40 pounds, was found in 1857; part of it is in the collection of Amherst College.

Still a third mass, found in 1873, is known to collectors as the Duel Hill iron. It weighed 25 pounds, and shows Widmannstädtian figures with octahedral structure, inclosing bright nickel iron. Deliquesces on account of inclosed ferrous chloride. Sp. gr. 7.46. The analysis by B. S. Burton gave:

Iron	94.24
Nickel	5.17
Cobalt	0.37
Copper.....	trace.
Insoluble ¹	0.15
	99.93

9. The Haywood County iron, described by Shepard, weighed only one-eighth of an ounce. It is highly crystalline. When polished and etched shows brilliant Widmannstädtian figures. It is also irregularly veined by a black mineral, which appears to be magnetite. Sp. gr. 7.419. Contains iron, nickel, chromium, and phosphorus.

10. The Rockingham County iron, from Smith's Mountain, 2 miles north of Madison; found in 1866 in an old field grown up with pines, but cultivated 10 or 15 years previously. It fell probably in the interval. The original weight was 11 pounds, the greater portion of which is preserved in the museum at Raleigh. It is highly crystalline and on etching

¹Silica, iron, nickel, chromium, and phosphorus.

gives fine Widmannstädtian figures, showing that it consists of probably three different kinds of iron. Contains also schreibersite in short, very minute quadratic crystals; the so-called rhabdite; and, according to J. L. Smith, *solid* chloride of iron. Sp. gr. 7.78. It has been analyzed by me (I) and J. L. Smith (II) as follows:

	I.	II.
Iron	90.41	90.88
Nickel	8.74	{ 8.08
Cobalt		{ 0.50
Copper	0.11	0.03
Insoluble phosphide	{ Iron	0.27
	{ Nickel (cobalt)	0.33
	{ Phosphorus	0.14
	100.00	99.46

11. A second mass of iron from near Old Mansion House, on Deep Spring Farm, Rockingham County, now in the State museum at Raleigh, has recently been analyzed by F. P. Venable. Results as follows:

Iron	87.01
Nickel	11.69
Cobalt	0.79
Chlorine	0.39
Phosphorus	0.04
Silica	0.53

100.45

12. A small meteoric iron, weighing only 428 grammes, was found on Linnville Mountain, in Burke County, about 1882. It came into the possession of Mr. Norman Spang, of Etna, Pennsylvania, from whom it was obtained by Mr. G. F. Kunz, who described it. Its dimensions are 65 mm. long, 35 mm. high, and 38 mm. wide. It is rough on one side, with very shallow pittings on the other; it shows traces of a black crust, and although the mass has not rusted, small drops of ferrous chloride have collected in crevices. It contains some troilite, but does not show the Widmannstädtian figures. A partial analysis was made by W. D. Weikel (I) in 1886, in the laboratory of the University of Pennsylvania; and later a more complete analysis was reported by J. E. Whitfield (II):

	I.	II.
Iron	85.83	84.56
Nickel	13.44	14.95
Cobalt	.73	.33
Copper	undet.	{ none
Sulphur		{ .12
Carbon		{ trace
Phosphorus		{ trace
Silicon		{ none
	100.00	99.96

The iron is now with the Kunz collection in the imperial cabinet at Vienna.

13. Another iron from Burke County was found by a plowman about 2 miles from Bridgewater Station, near the McDowell County line. It was broken by some laborers into two pieces, weighing $10\frac{1}{2}$ and $18\frac{1}{2}$ pounds respectively. Traces of crust are still visible upon its surface, which is very much oxidized. The iron is highly octahedral in structure, and between the plates schreibersite is visible. On the etched surface Widmannstädtian figures are shown similar to those on the Cabin Creek and Glorieta meteorites. Sp. gr. of a fragment 6.617. Analysis by F. P. Venable:

Iron	88.90
Nickel	9.94
Cobalt	0.76
Phosphorus	0.35
Chlorine	0.02
	99.97

For the foregoing particulars I am indebted to Mr. G. F. Kunz, the present owner of the meteorite.

14. In the latter part of 1880 a meteoric iron weighing 72 troy ounces was found on a farm near Ellenboro, in Rutherford County. Somewhat over one-half of the mass was given to Mr. S. W. Cramer, of the United States assay office at Charlotte, who recognized its character, and by him a liberal portion was given to the U. S. National Museum. The iron is highly crystalline, and shows Widmannstädtian figures upon its polished surface even before etching. It contains small patches of troilite. From its description by Mr. L. G. Eakins the following analysis is taken:

Iron	88.05
Nickel	10.37
Cobalt	0.68
Copper	0.04
Phosphorus	0.21
Sulphur	0.08
Silicon	0.02
	99.45

15. An iron from Davidson County, identified by Mr. W. E. Hidden, is described by him as follows:

On the 19th of July, 1879, while Mr. Gray W. Harris was prospecting for gold on his plantation near Lick Creek, Davidson County, he found in a ditch a nugget of what appeared to him to be silver. It was covered with a thick, scaly crust of iron oxide; weighed $2\frac{1}{2}$ pounds; was pear-shaped; measured $4\frac{1}{2}$ by $2\frac{1}{2}$ inches over its broadest surface, and about 1 inch in thickness. Wherever cut or hammered it showed a white metallic mass underlaying the red crust.

This iron has been analyzed by Dr. J. Lawrence Smith and J. B. Mackintosh. I here give the average of four closely agreeing analyses:

Iron	93.00
Nickel	5.74
Cobalt	0.52
Phosphorus	0.36

99.62

Traces of sulphur, chlorine, and copper; carbon not determined.

This iron does *not* show the customary Widmannstädtian figures.

Apart from the meteoric irons, the following meteoric stones have fallen in North Carolina, and may properly be noted at this point:

16. The Cabarrus County stone fell on October 31, 1849. It weighed 18½ pounds and was an irregularly shaped mass, resembling a truncated four-sided pyramid; on the base a rounded, undulatory surface, coated with a black, coherent crust; tough; color, dark bluish gray, mottled with grains and crystals of lighter color; in structure, subporphyritic. Sp. gr. 3.60–3.66.

According to C. U. Shepard it contains:

Nickeliferous iron (with chrome)	6.320
Sulphide of iron	3.807
Silica	56.168
Ferrous oxide	18.108
Magnesia	10.406
Alumina	1.797
Lime, soda, potash, and loss	3.394
	100.000

17. The Nash County stones fell May 14, 1874, near Castalia. Perhaps a dozen or more stones fell, of which 3 have been found, 1 of over 12 pounds, the others of 2½ and 1½ pounds. They have a dull black coating and consist of darker and lighter portions. Sp. gr. 2.601. The analysis by J. L. Smith shows that it is composed of—

Nickeliferous iron	15.21
Stony mineral	84.79

The nickeliferous iron contains:

Iron	92.12
Nickel	6.20
Cobalt	0.41

Copper and phosphorus not determined.

98.73

The stony portion is partly soluble in acids, leaving 47·2 per cent undissolved:

	Insoluble part.	Soluble part.
Silica	52·61	38·01
Alumina	4·80	0·46
Ferrous oxide	13·21	17·51
Magnesia	27·31	41·27
Soda with traces of potash.	1·38	.....
Sulphur .....	.....	1·01
	99·31	98·26

The insoluble portion is mostly bronzite; the soluble, chrysolite, with small particles of anorthite.

18. The Haywood County stone was seen to fall by Mr. W. A. Harrison of Ferguson, about 6 p. m., July 18, 1889, and was picked up hot. It weighed about 8 ounces, and very closely resembled the stones from Mócs, Transylvania. In shape it was slightly oblong, and was covered with a deep black crust, which, broken at one end, showed a perfect chondritic structure, with occasional specks of iron. It was sent to New York to Mr. G. F. Kunz, who furnishes its description; but in December, 1889, it was unfortunately lost.

19. A peculiar substance, consisting principally of iron and silicon, supposed to be of meteoric origin, has been found near Rutherfordton. Shepard described it and called it "ferrosilicene."

In a recent "List and Description of the Meteorites of North Carolina," by Prof. F. P. Venable, published in the "Journal of the Elisha Mitchell Scientific Society," three other occurrences are noted, of which little is known. An iron weighing 56 grammes found in Alexander County in about 1875, is now owned by S. O. H. Bailey, of Oscawana, New York. Another fragment of iron marked as being from Caldwell County is in the State Museum at Raleigh. Also a fragment of a meteoric stone has been reported from Ashe County, but it may be identical with the Grayson County, Virginia, fall.

LEAD.

A few small irregular lumps of what has been alleged to be "native lead" were received from Messrs. Bechtler, of Morganton. They were said to have been dug up 4 miles north of Morganton, in making a road near the Catawba River.

ANTIMONY.

A small piece of native antimony was received from Dr. Hunter. It is quite pure and free from arsenic, but coated with a crust of antimonic oxide. From a small vein in Burke County.

SULPHUR.

It is frequently met with in minute crystals in cellular quartz, filling the cavities, formerly occupied by pyrite, in Cabarrus, Mecklenburg, Gaston, Caldwell, Surry, and Stokes Counties; it also occurs diffused through the interstices of a white quartzose sandrock in Lincoln County.

DIAMOND.

This rare gem has been repeatedly found in North Carolina, and the following occurrences are well established. In every instance it was found associated with gold and zircons, sometimes with monazite and other rare minerals, in gravel beds resulting from gneissic rocks, but it has never been observed in the North Carolina itacolumite or any débris resulting from its disintegration. The first diamond was found in 1843 by Dr. M. F. Stephenson, of Gainesville, Georgia, at the ford of Brindletown Creek. It was an octahedron, valued at about \$100. Another from the same neighborhood came into possession of Prof. G. W. Featherstonhaugh, while acting as United States geologist.

The third diamond, at Twitty's Mine, Rutherford County, was observed in 1846 by Gen. Clingman, in D. J. Twitty's collection, and has been described by Prof. Shepard. Its form is a distorted hexoctahedron and its color yellowish.

The fourth came from near Cottage Home, in Lincoln County, where it was discovered in the spring of 1852, and was recognized by Dr. C. L. Hunter. It is greenish and in form similar to the last, but more elongated.

A very beautiful diamond was found in the summer of 1852 in Todd's Branch, Mecklenburg County. It was nearly of the first water and a perfect crystal. It was in possession of the late Dr. Andrews, of Charlotte. Dr. Andrews informed me that a very fine diamond of about the size of a small chinquapin, and of a black color, had been found at the same locality by three persons while washing for gold. In their ignorance, believing that it could not be broken, they smashed it to pieces. Dr. Andrews tested the hardness of a fragment, which scratched corundum with facility, proving it to be a diamond.

A very beautiful octahedral diamond of first water was found many years ago at the Portis Mine, Franklin County. There is a report that a second one has been found at the same locality.

A small diamond was found a few years ago in McDowell County, on the head waters of Muddy Creek.

Dr. C. Leventhorpe, of Patterson, North Carolina, reports that a small, poor diamond was found in a placer mine in Rutherford County a number of years ago; it was given to Prof. C. U. Shepard, who put it in his collection.

G. F. Kunz states that a diamond weighing $4\frac{1}{2}$ carats, or 873 mg., was found on the Alfred Bright farm, in Dysortville, McDowell County, in the summer of 1886. It is quite perfect, but not pure white, having a faint grayish green tint. In form it is a distorted hexoctahedron with

partial twinning. Its specific gravity is 3.549, and it measures 10mm. in length and 7mm. in width.

According to W. E. Hidden another diamond was found in 1877 by a small boy in the same region as the one above mentioned. It weighed 2½ carats, was shaped very much like a smooth, flat field-bean, and was very well polished naturally. It was white, but somewhat flawed. The crystal planes were very obscure. It was finally sent to New York and cut into a small gem.

GRAPHITE.

Graphite has been found at numerous localities. It forms large beds in the gneissic and micaceous schists. Sometimes very minute scales are disseminated through the gneissic and micaceous, and occasionally the limestone rocks. In most places it is impure and gritty, at others purer and better varieties have been obtained. The largest beds occur in Wake County, others in Lincoln, Cleveland, Catawba, Alexander, Stokes, Surry, Wilkes, Person, Alleghany, Johnston, and Yancey Counties.

SULPHIDES, ETC.

SULPHIDES AND TELLURIDES OF METALS OF THE SULPHUR AND ARSENIC GROUPS.

STIBNITE.

Found in the northern part of Granville County, on the land of Maj. N. A. Gregory.

BISMUTHINITE.

In very minute crystals and specks in chloritic slate associated with gold, chalcopyrite, and pyrite at the Barnhardt vein of Gold Hill, Rowan County.

TETRADYMITES.

This rare mineral has been found associated with gold in quartz at David Beck's mine, 5 miles west of Silver Hill, and at the Allen mine, in Davidson County; also, in minute scales in Cabarrus County, at the Phoenix mine, Boger mine, Cullen's mine, at the Asbury vein in Gaston County, at Capt. Mills's mine in Burke County, and Capt. Kirksey's, McDowell County.

I have analyzed the tetradymite from Davidson County and that from the Phoenix mine, Cabarrus County; after deducting quartz and gold found:

	Davidson County.	Phoenix mine.
Tellurium	33.84	36.28
Sulphur	5.27	5.01
Selenium	trace	.....
Bismuth	61.35	57.70
Copper .....	.....	0.31
Iron .....	.....	0.54
	100.46	99.84

MOLYBDENITE.

In granite and quartz veins, in fine scales in the neighborhood of the Pioneer Mills mine, Cabarrus County; also, in Guilford County, and at Peach Bottom mine, Alleghany County; at Haskett's, Macon County; and in many other places west of the Blue Ridge.

SULPHIDES, ETC., OF METALS OF THE IRON, GOLD, AND TIN GROUPS.

ARGENTITE.

In small grains, associated with native silver, in the ores of Silver Hill, Davidson County, and the McMakin mine, in Cabarrus County; also in slates of Montgomery County. (Emmons.) Found also at the Cheek mine, Moore County, at Higdon's mine, in the Cowee Mountains, and in Swain County.

GALENITE.

At Silver Hill sometimes, in highly argentiferous, crystalline, bluish gray masses, also coarsely and finely granular. In coarse-grained masses at the Hoover mine and Boss mine, in Randolph County, and the McMakin mine, Cabarrus County; in small quantities at Miller's mine, Baker mine, and Little John mine, in Caldwell County; at Pax Hill, in Burke County; in Alexander County; at Cansler & Shuford mine, the Asbury mine, the King's Mountain mine, the Crowder's Mountain barite mine, and the Oliver mine, in Gaston County; highly auriferous and argentiferous galenite occurs at the Stewart mine, Lemmond mine, Phifer mine, Smart mine, Moore mine, and Crowell mine, and elsewhere in Cabarrus; and at Long mine in Union County; at the Cheek mine, Moore County; with copper ores it is found at the Clegg's and Williams's mines, in Chatham County; the Peach Bottom mine, in Alleghany County; at Marshall, in Madison County; with gold at Murphy, Cherokee County, and in Lincoln, Macon, Swain, and Surry. Specimens of fine-grained galenite have also been obtained from Beech Mountain, in Watanga; on Elk Creek, Wilkes County; and at the Steele mine, Montgomery County.

ALTAITE.

This exceedingly rare mineral occurs associated with gold, nagygite, galenite, etc., at King's Mountain mine, Gaston County.

BORNITE OR VARIEGATED COPPER ORE.

I have crystalline specimens of bornite from Guilford County, probably from the Gardner Hill mine; it is of somewhat rare occurrence in North Carolina, but has been found with other copper ores at Clegg's mine, in Chatham County; Marshall, in Madison County; Peach Bottom, Alleghany County; the Gap Creek mine, Ashe County; near Concord, Cabarrus County, and at Well's farm in Gaston.

SPHALERITE OR ZINC BLENDE.

This mineral occurs in quantities sufficient for exploitation only at a few mines. The principal localities are Silver Hill and Silver Valley, in Davidson County, and the McMakin mine, in Cabarrus County, where it is found associated with silver ores; associated with gold ores at Stewart, Lemmond, Long, and Moore mines, and rarely at the Union mine, in Union County; in limestone at Dobson's mine, Cedar Cove, McDowell County, and in Macon County; in small quantities with other ores at King's Mountain mine in Gaston County; at Clayton, in Johnston County, near Marshall; in Madison County, and on Uwharrie River, Davidson County; at the Steele mine, Montgomery County; at Peach Bottom mine, Alleghany County; Crowder's Mountain, Gaston County; and the Smart mine, Union County.

CHALCOCITE.

This is also a copper ore, but rarely met with in the State. The massive variety has been found at the Ore Knob mine, in Ashe County; also associated with bornite at Gap Creek mine, Ashe County; the Waryhut and Wolf Creek mines, in Jackson County; the Gillis mine, and Mill Creek mine, in Person County; also at the Pioneer Mills mine, in Cabarrus; at A. Nichol's, in Swain; and in Guilford County, as a product of the alteration of other copper ores and rarely with silver ores at Silver Hill.

TROLITE.

Interlaminated with the meteoric iron from the Black Mountain, Buncombe County, and in other meteorites, q. v.

PYRRHOTITE.

Compact pyrrhotite is found at the bottom of the Asbury shaft in Gaston County; also associated with chalcopyrite at the Elk Knob mine, Ashe County, on East Fork and West Fork of Pigeon River, Haywood County, in Transylvania County, near Hickory in Catawba County, at Thorn Mountain mine, Macon County, and in Surry and Wilkes (Trap Hill).

SCHREIBERSITE (RHABDITE).

This mineral, of meteoric origin, has been observed in minute quadratic prisms of great brilliancy in the meteoric iron of Smith's Mountain, Rockingham County, and in less distinct particles in many of the meteoric irons.

PYRITE.

Pyrite is one of the most common minerals of North Carolina. It is not only found in globular and irregularly shaped crystalline masses in many of the marl beds of the eastern counties, but many of the gneissic rocks and slates and the traps contain it in considerable quan-

ties, and besides it is found in almost every mine of the State. In Cleveland and Rutherford it is a common constituent of the feldspathic, slaty gneisses, disseminated in minute grains, and its ready oxidation rapidly disintegrates the rocks, so that during the late war copperas was extensively and cheaply manufactured here by simply breaking and heaping the half decomposed fragments of rock in hoppers, leaching and crystallizing. In the gold mines the associated pyrite is generally auriferous. Cubical crystals occur at Hickory, Catawba County; Asbury mine, Gaston County; Soapstone quarry, 12 miles northeast of Statesville; Silver Hill, Gold Hill, and many other localities. Combinations of cubes and octahedra are found in Clegg's mine, Chatham County, and in the Guilford County gold and copper mines; the pyritohedron, often in combination with cubical and octahedral planes, is found at the Stewart mine, in Union County; Cambridge mine, Guilford County; Long Creek mine, Gaston County; Rudesill mine, Mecklenburg County, etc. Large veins of compact pyrite occur in Gaston County.

CHALCOPYRITE.

This is very abundant, and, indeed, is the only reliable copper ore in North Carolina. It has been found in fine crystals at the Gardener Hill mine, probably also at other copper mines of Guilford County. It is very abundant and largely mined at Ore Knob, Ashe County, and promises to be the ore of all the gold mines, which in depth change into copper mines in Guilford, Cabarrus, and Mecklenburg Counties; also at the Clegg mine, in Chatham County; the Conrad Hill and the Emmons and other mines in Davidson County; Peach Bottom and elsewhere, Alleghany County; and at Gap Creek, Ashe County; Newlin's mine, Alamance County; in Alexander; in the gold mines of Union, Rowan, and Gaston Counties; at Macpelah Church, in Lincoln County; in Granville and Chatham Counties; near Hillsboro; near Chapel Hill, Orange County; near Raleigh, in Wake County; in Surry, Wilkes (Trap Hill), Yadkin, Watauga, and Swain counties; and some of the mica mines of Mitchell County; the copper mines of Macon and Jackson Counties—in more than thirty counties, and hundreds of localities; at many of them it is found associated with other ores.

BARNHARDTITE.

A peculiar and rich copper ore, first noticed on Daniel Barnhardt's land and then at the Pioneer Mills mine, in Cabarrus County. It also occurs at the Cambridge mine, in Guilford County; at the Wilson mine and the McGinn mine, in Mecklenburg County; and at Elk Knob, Watauga County. The true barnhardtite occurs in compact masses—having, on a fresh fracture, a very pale bronze yellow color, but rapidly tarnishing with brownish pinchbeck, also with rose red and purplish colors. That from Barnhardt's land has been analyzed by W. J. Taylor (I), that from Pioneer Mills by me (II) and by P. Keyser (III).

	I.	II.	III.
Copper.....	47.61	46.69	48.40
Iron.....	22.23	22.41	21.08
Sulphur.....	29.40	29.76	30.50
Silver.....	trace		
	99.24	98.86	99.98

There occurs at the Pioneer Mills, associated with the barnhardtite, another copper ore, which appears to be uniform in composition and does not look like a mixture. It is paler than copper pyrites and contains, according to the analyses of W. J. Taylor (I) and Charles Froebel (II):

	I.	II.
Copper.....	40.2	40.5
Iron.....	28.4	28.3
Sulphur.....	32.9	31.1
	101.5	99.9

MARCASITE.

According to the information received from Dr. Asbury, of Charlotte, this mineral occurs in Iredell County.

LEUCOPYRITE.

It has been observed by the late Dr. Asbury, at the Asbury mine, in Gaston County; in nodular masses almost completely altered into scorodite at Dr. Halyburton's, in Iredell County; and at Drum's farm, on White Plains, Alexander County.

ARSENOPYRITE OR MISPICKEL.

It occurs sparingly in North Carolina, and has been observed in minute crystals, associated with gold ores, at the Lemmond and Stewart mines, Union County, and at the Barringer mine and George Ludwick's mine in Cabarrus County. It has been found by Gen. Clingman in Cleveland County, and by Dr. Asbury, at Ore Knob mine in Ashe County, the Honeycutt vein at Gold Hill, and highly auriferous at the Asbury mine, in Gaston County. It also occurs near Cooke's Gap, Watauga County, in fine crystalline particles, disseminated through siliceous rock; and, according to Hidden, at Brindletown (?).

NAGYAGITE.

This exceedingly rare mineral, which previous to its discovery in North Carolina was known only from Transylvania, in Hungary, occurs sparingly in minute crystals and foliated particles at the King's Mountain mine, where it is associated with altaite, gold, etc.

COVELLITE.

Resulting from the decomposition of chalcopyrite and associated with it, covellite occurs at several of the North Carolina copper mines, for instance at the Phoenix mine, etc., in Guilford County; and in fine scales at the Gillis mine and Mill Creek mine, in Person County.

SULPHARSENIDES, SULPHANTIMONIDES, ETC.

PROUSTITE (?).

Microscopic crystals of a bright aurora red color occur with talc, rhodochrosite, etc., at the McMakin mine. As they are rich in silver they are probably proustite.

AIKINITE OR CUPREOUS COSALITE (?).

A mineral containing sulphur, bismuth, lead, and copper, and therefore probably aikinite or cosalite, has been observed in small particles in quartz associated with chalcopyrite at Col. White's mine, Cabarrus County.

TETRAHEDRITE.

Two varieties of tetrahedrite are found in North Carolina, the highly argentiferous (freibergite), in small compact patches of subconchoidal fracture and a dark gray color, associated with silver, sphalerite, galenite, talc, magnesite, etc., at the McMakin mine, Cabarrus County, and the other in the same county at George Ludwick's mine, 14 miles northeast of Concord, rarely crystallized, but mostly massive and of a dark lead-gray to iron color. It is associated with chalcopyrite, scorodite, arseniosiderite, etc., in a quartz vein.

The tetrahedrite from the McMakin mine has been analyzed by myself (I) and by Mr. J. S. de Benneville (II) in my laboratory. The second sample was very pure, and was collected about twenty years ago, and twenty years after the first.

	I.	II.
Sp. gr.		4.776
Sulphur	25.48	26.55
Antimony	17.76	6.90
Arsenic	11.55	13.49
Copper	30.73	37.45
Iron	1.42	2.05
Zinc	2.53	5.67
Silver	10.53	6.47
Manganese		0.45
	100.00	99.12

There is probably an occasional small admixture of argentiferous tetrahedrite with the minerals associated with the native silver of Silver Hill, as they sometimes give before the blowpipe incrustations of antimony.

COMPOUNDS OF CHLORINE, ETC.

HALITE OR COMMON SALT.

Found in the waters of the Atlantic Ocean, from which it can be obtained by evaporation, and in wells and springs at several points in the Triassic beds, e. g., in Chatham, Orange, and Rockingham Counties.

CERARGYRITE.

In some of the gold ores of Scott's Hill, in Burke County, silver is found after roasting; a specimen, which I had an opportunity to examine, makes it probable that it is present as chloride of silver or cerargyrite.

FERROUS CHLORIDE.

It has been observed in the meteoric irons from Asheville and from Jewel Hill, Madison County, which are wet from the deliquescence of this salt. In the Rockingham County iron it has been found in the solid state.

FLUORINE COMPOUNDS.

FLUORITE.

According to Gen. Clingman, fluorite occurs at Brown Mountain, Burke County; also in Watauga; with barite and hematite below Marshall, Madison County, and at King's Mountain, Gaston County. In pseudomorphs after apatite rarely at Ray's mine, Yancey County.

YTTROGERITE (?).

A few minute, deep violet-blue spots were observed in association with pyrochlore, black tourmaline, orthoclase, quartz, etc., at Ray's mica mine, Hurricane Mountain, Yancey County, which are probably yttrocerite.

OXYGEN COMPOUNDS.

OXIDES.

CUPRITE.

Cuprite or the red oxide of copper occurs near the surface in some of the copper mines. It is rarely found in small cubical crystals at Cullen's mine and in octahedra upon native copper at the Union Company copper mine in Cabarrus County. It has been observed at Olegg's mine, Chat-

ham County; at Silver Hill, at the Harris mine, in Person County; in Caldwell, Lincoln, Alleghany, and Ashe Counties, and upon the gossan of the Waryhut mine, Jackson County. At the McGinn mine, in Mecklenburg County, and several of the Guilford County copper mines, cuprite in acicular and capillary crystals (so-called chalcotrichite) was formerly found in beautiful specimens.

MELACONITE.

It is found occasionally as a black coating or a powder associated with cuprite at the McGinn mine, and with zincblende, etc., sparingly at Silver Hill; also at Cullowhee mine, Jackson County.

CORUNDUM.

One of the most interesting minerals, which occurs in the State of North Carolina in a great many varieties, is corundum. It was first noticed when, in the spring of 1847, a large mass of a dark blue cleavable variety was found 3 miles below Marshall, in Madison County. Gen. Clingman's attention having been called to it, he searched for more, and obtained in 1848 a second piece of about half the size. It has since been found $2\frac{1}{2}$ miles north of Marshall, at Haynie's, associated with margarite and rutile. It was afterward found by Dr. C. L. Hunter, in small quantity, in reddish and bluish masses, sometimes crystallized, at Crowder's Mountain, and afterward at Clubb's Mountain and King's Mountain, Gaston County. About 20 years ago large beds of corundum were discovered by Hiram Crisp, near Franklin, in Macon County, at Culsagee or Corundum Hill. Here it is from 10 to 14 feet thick, embedded in prochlorite, between chrysolite and hornblende gneiss. The corundum itself presents many varieties. Beautiful hexagonal pyramids with basal and rhombohedral planes and of many shades of color, from almost colorless to yellow and deep red, rarely to green, have been found. Some of the crystals are very large, one, for instance, measured 5 feet 2 inches in length. Usually it occurs massive, often in large cleavage masses, frequently of variable colors; some are red and semitransparent and in small fragments even transparent and form a fair ruby; other specimens of reddish or gray corundum have disseminated through the mass the most beautifully colored azure-blue sapphire. Unfortunately the particles of the red and blue are usually too small to have any value as gems. A very peculiar variety is that consisting of white and blue bands. At this locality corundum is associated with prochlorite, black and greenish black spinel, tourmaline, small quantities of rutile, etc., and where it occurs in the mica schist, with muscovite and margarite.

Other localities in Macon County where corundum is mined are Jacob's and Haskett's mines, on Ellijay Creek, and at Robinson's mine, on Sugartown Fork. It is also found at Houston's mine, and at Moore & Higdon's. At West's mine "ruby" corundum occurs in small, irregular crystals and crystalline masses associated with cyanite.

At the Hogback mine, in Jackson County, corundum associated with muscovite, margarite, and tourmaline is embedded in chlorite. At the hanging wall feldspar with crystals of corundum is met with. A small quantity, not exceeding a few ounces, of corundum has been found near the chrysolite outcrop at Webster, Jackson County, and also on Scott's Creek. At Cullakenee mine, in Clay County, a grayish white and blue corundum is found associated with margarite, zoisite, actinolite, etc., and a red variety, sometimes of a deep ruby color, associated with zoisite, smaragdite, cyanite, and a feldspar.

At Penland's, on Shooting Creek, in Clay County, corundum is found associated with margarite and willcoxite. It also occurs in Cherokee County, on Valley River.

In Haywood County, 2 miles northeast of the Pigeon River, where the Asheville road crosses it near a serpentine outcrop, a small quantity of corundum has been found, also on the west fork of Pigeon. About 2 miles north of this is located the Presley mine, which has furnished the most beautiful specimens of blue and grayish blue corundum largely altered into muscovite and albite.

About 20 miles northeast of this mine, in Madison County, is the Carter mine, which yields a white and pink variety of corundum, both in crystals and laminated masses. It is associated with greenish black spinel and prochlorite. Very rarely crystals of asteriated sapphire, implanted on a micaceous rock, are found at this locality.

Corundum is found also in Mitchell County, near Bakersville, in chrysolite.

In the broad-bladed cyanite of Wilkes County, corundum is met with in small reddish brown particles, and in the cyanite of the Swannanoa Gap, in Buncombe County, blue, bluish, white, and reddish corundum. Also at N. P. Watkins's, in the same county.

It is found in the gravel 2 miles west of Statesville, in Iredell County, associated with cyanite, but rarely imbedded in it. Highly interesting crystals and crystalline masses of grayish white corundum more or less altered into muscovite and tourmaline have lately been found by Mr. J. A. D. Stephenson, at Belt's Bridge, and beautiful hexagonal prisms of a pale brownish corundum, with a partial alteration into soda margarite, at Hendrick's farm near Belt's Bridge, Iredell County.

Above Lock's Bridge, on the south side of the South Yadkin River, red corundum occurs largely altered into greenish fibrous and compact muscovite; at the Chipley Farm and Austin's Farm, $3\frac{1}{2}$ miles above Lock's Bridge, gray corundum partly altered into margarite; at Liberty Hill, 3 miles above Austin's Farm, it is altered into margarite and prochlorite; and at Hunting Creek, north of Statesville, blue corundum is partly altered into the rhaetizite—variety of cyanite.

Crystals of corundum surrounded by fibrolite occur at Shonp's Ford in Burke County, and Hidden reports corundum of three colors,

including the "ruby" variety, from Brindletown. It is also reported from Stokes County. In the neighborhood of Morganton corundum is found in muscovite schist, and in the gravel deposits of Burke, McDowell, and Rutherford Counties small grains and crystals, often partly altered into muscovite, are frequently met with. The granular variety of corundum, "emery," has been observed at Crowder's Mountain and also in the titaniferous iron ore belt near Friendship, Guilford County.

At Brackettstown, McDowell County, massive grayish white corundum has been found, and in Mitchell County, at Plum Tree Creek, well developed crystals of a brownish color. Rarely small remnants of corundum are found in the pyrophyllite slates of Chatham County. The associated minerals of corundum are mostly the result of the alteration of corundum, which latter has furnished the alumina necessary for their formation.

HEMATITE.

Red oxide of iron or hematite is one of the most important iron ores of North Carolina. The compact ore, sometimes more or less mixed with the specular variety, forms large beds in Chatham County, at Evans's and Kelley's ore beds, Ore Hill, Buckhorn, etc.; also in Moore County, 12 miles east of Carthage, in Orange County, at Chapel Hill, 6 miles south of Hillsboro; and at J. Woods's, Knap of Reeds; and in Macon, Swain, Buncombe, and many other counties. Foliated and micaceous hematite occurs at Buckhorn, Ore Hill, 7 miles west of Lockville, in Chatham County; Snow Creek, Stokes County; 4 miles south of Salem, in Forsyth County; at Mount Tirzah, in Person County; near Gudger's, 9 miles below Marshall, on the French Broad River, and near Franklinville, Randolph County, and elsewhere. A very fine variety of slaty hematite with crystals of magnetite is found at Cooke's Gap, Watauga County; and both here and at Richlands, in Caldwell County, and near Fisher's Peak, in Surry County, martite occurs. Other localities are: Smith's River, 2 miles east of Morehead's factory, in Rockingham County; a granular variety 1 mile east of Gaston, at House's mill, Cabarrus County; at Hickory, Catawba County; in Lincoln, Gaston, and Mecklenburg Counties, etc. The ocherous variety has been observed in Buncombe County, 4 or 5 miles west of Asheville, at Valley Town, on Peachtree Creek, Cherokee County, and in a great many gold mines. Hexagonal scales of hematite in crystals of quartz occur at King's mill, Iredell County.

MENACCANITE.

Many of the titaniferous iron ores are mixtures of true magnetite and menaccanite, others belong to this species, and others again are really magnetites, in which a portion of the iron is replaced by titanium. Our present knowledge of these ores is too limited to put all the varieties occurring in the State with certainty in the place where they belong.

Those from the following localities appear to belong under this head: Franklin, in Macon County; Big Laurel, in Madison County; on Ivy, Yancey County; Crab Orchard, Cane Creek, Flat Rock, and Grassy Creek, in Mitchell County; Damascus, Iredell County; Old Harris mine, 12 miles southeast of Charlotte, south end of Crowder's Mountain, and at Wills's, Gaston County; Yadkin River, near Patterson, in Caldwell County, and the neighborhood of Raleigh. Menaccanite in quartz occurs at Fisher Hill, Guilford County. Iserite is frequent in the gold sands of Rutherford, Burke, and McDowell Counties, etc. Menaccanite also occurs at Shoup's Ford, Burke County; at Huffman's, Catawba County; at Culsagee, Macon County; at Haynie's, Madison County, and in Person, Watauga, and Lincoln Counties.

Associated with oligoclase, forming cross fissures in the corundum vein at the Carter's mine occur *two* varieties of menaccanite (ilmenite): (1) of a brownish black color with a somewhat purplish hue, in small masses with indistinct crystalline structure and basal cleavage; (2) in rounded nodules, $1\frac{1}{2}$ to 2 inches in diameter, irregular shape, very fragile, and breaking into small fragments without regular form, and a subconchoidal fracture, resembling the slag-like magnetite from Unkel on the Rhine. Neither variety is magnetic. Mr. Harry F. Keller has analyzed them (I) and (II). I have also analyzed a variety of black, somewhat granular menaccanite (ilmenite) from near Franklin, Macon County (III):

	I.	II.	III.
Sp. gr.	4.67	4.68	.....
Titanic oxide	52.73	52.64	48.61
Ferric oxide	8.08	10.07	9.76
Ferrous oxide	33.08	31.11	40.22
Magnesia	5.33	5.33	1.38
Silica	0.14	.....	.....
	99.36	99.15	100.00

Menaccanite is also named by Hidden among the minerals occurring at Brindletown.

SPINEL.

The only spinel which has been found in North Carolina is that which results from the alteration of corundum, and it is usually a mixture, in variable proportions, of the varieties pleonaste and hercynite, sometimes with an admixture of that called picotite. In the chlorites of the Culsagee mine it is found in octahedral crystals with dodecahedral planes, but usually massive, coarsely to finely granular. Its color is black, but by an incipient alteration on the surface it generally becomes of a peculiar greenish gray color and satin-like luster. Some varieties are blackish green, but so dark that the green can be observed

only in thin splinters; it is rarely found at the Cullakence mine in Clay County, but frequently met with at the Carter mine in Madison County, where it is mostly of a very dark green color. Several varieties from the Culsagee mine have been analyzed. (I) A fine grained variety of 3.766 sp. gr., by G. A. Koenig; (II) a coarser grained variety of 3.797 sp. gr., by the same; and (III) the coarse-grained crystallized dark green, of 3.695 sp. gr., by myself. IV is an analysis of a greenish black spinel from the Carter mine, sp. gr. 3.77, made by Mr. J. S. de Benneville in my laboratory. In I, II, and III some mechanical admixtures have been deducted:

	I.	II.	III.	IV.
Alumina.....	54.32	56.58	66.63	67.54
Chromic oxide.....	3.96	2.28	trace	.....
Ferrie oxide.....	11.51	9.66	1.80	.....
Ferrous oxide.....	11.16	14.60	11.35	13.38
Magnesia.....	19.05	18.88	19.86	18.62
Cupric oxide.....	.....	.....	0.11	.....
Nickelous oxide.....	.....	.....	0.25	.....
	100.00	100.00	100.00	99.54

Black octahedral crystals of vitreous luster from the Tibbets mine, in Macon County, are probably pleonaste.

GAHNITE.

Gahnite, or automolite, is mentioned by Gen. Clingman as occurring in Cleveland County; also in Mitchell County, at the Deake mine, where it occurs in small, compact, dark green masses, in part altered into and surrounded by fibrous muscovite.

I have made an examination of it and found:

Copper oxide.....	0.30
Zinc oxide.....	38.05
Manganese oxide.....	0.29
Magnesia.....	0.79
Ferrous oxide.....	1.14
Ferrie oxide.....	4.50
Alumina.....	54.86
	99.93

Sp. gr.. 4.576

MAGNETITE.

This is the most abundant and most valuable iron ore in North Carolina. It occurs in small octahedral crystals in the granite at Dunn's Mountain, in Rowan, and in the granites and gneisses and (especially) the syenites very commonly in many counties, and in the slates at Fisher's Peake and Chestnut Mountain, in Surry County; also at Bull's Head, in Alleghany County, in quartzose sandrock and hematite at Cooke's Gap, Watauga County; at Capp's Hill, in Mecklenburg County;

and Fisher Hill, in Guilford. It occurs in its granular variety, mixed with muscovite, manganiferous garnet, etc., at Buckhorn, in Chatham County, and mixed with menaccanite and occasionally with corundum, in a succession of beds, passing through the gneissic rocks of Davidson, Guilford, Forsyth, and Rockingham Counties. There appear to be several isolated outcrops northwest of this band and between it and the Dan River, and also in Randolph and Montgomery Counties. A band of granular magnetite, free from titanite acid, mixed with actinolite, tremolite, and a little epidote, passes from near Danbury in Stokes County, and also from Surry County, through Yadkin, Forsyth, Davie, Lincoln, and Gaston Counties. It contains some of the most valuable ore beds. It is also found in large beds near Newton, in Catawba County; at Comb's farm, Summer's farm, and Thomas Payne's farm, in Iredell County; also in Orange, Mecklenburg, and Cabarrus Counties. Some very valuable ore beds of crystalline magnetite occur in Swain, Madison, Macon, Haywood, Burke, Alexander, Wilkes, Orange, Mitchell, and other counties, the most extensive probably at Cranberry. A granular ore, similar to the ores of Surry County, has been worked at the north fork of New River, near the mouth of Helton Creek, and on Horse Creek, in Ashe County. There are many other localities in which magnetite occurs, but they are of less importance than those enumerated.

CHROMITE.

Occurs in the chrysolite beds, which form lenticular masses in the hornblende slates, etc.; in minute octahedral crystals and granular masses at Culsagee; also at Higdon's, Ellijay's Creek, and at Moore's mine, in Macon County; near Webster, at Hogback, at Ainslie's, and on Scott's Creek, in Jackson County; on Mining Creek, near Hampton's, in Yancey County; at Cullakenee, in Clay County; Carter's mine, in Madison County; in small quantities near Bakersville, Mitchell County; on South Toe River, on Rich Mountain, Watauga County, and in Ashe County. Where it is found in abundance, it may become a valuable ore when it can be brought to market at a low freight. A small admixture of chromite is found in the titaniferous magnetite belt of Guilford, Rockingham, and other counties. Crystals of chromite are frequently met with in the gold sands of Burke, McDowell, Rutherford, etc.

The analysis which I have made of a compact variety of chromite from near Franklin, Macon County, gave:

Chromic oxide	44.15
Alumina	22.41
Ferric oxide	5.78
Ferrous oxide	11.76
Magnesia	15.67

99.77

Sp. gr., 4.319.

The pure octahedral crystals of chromite washed out of gravel at Oulsagee, Macon County, have been analyzed in my laboratory by Mr. J. S. de Benneville. Sp. gr. 4.79. Deducting 2.70 per cent of silica, the mineral contains:

Chromic oxide	56.60
Alumina	5.31
Ferric oxide	10.98
Ferrous oxide	19.91
Magnesia	7.20
	100.00

CASSITERITE.

Found in 1882, near King's Mountain, Gaston County, by Mr. R. T. Claywell. It was first recognized as cassiterite by Hidden, and the mineral was afterward more fully investigated by Prof. C. W. Dabney, jr. It generally occurs in irregular cryptocrystalline and massive lumps of a dark brown color, but also in many shades from colorless to black. The largest piece yet found weighed about 14 ounces. Specific gravity, 6.6 to 6.9. According to Hidden, the ore is sparsely disseminated over a very considerable area in and about King's Mountain Village, but no paying deposits have yet been discovered. Analyses by Dr. Dabney gave for two varieties:

	Light grayish.	Dark brown.
Stannic oxide	94.70	82.99
Tungstic oxide	0.92	1.14
Sulphur	trace	0.46
Arsenic	trace	trace
Iron and manganese oxides	undet	undet
Silica	1.76	2.36
	97.38	86.95
Metallic tin	74.41	65.21

URANINITE.

It was found by Prof. Kerr at the Flat Rock mine, Mitchell County, in 1877, in small nodules of gummite and uranotil, forming the nucleus of these minerals, both of which are resulting from its decomposition. It has since been found at one or two other mines in Mitchell, especially at the Deake mine, in cubes and cubo-octahedrons, of sp. gr. 8.968 to 9.218; color, iron-black to brownish, according to the extent of the alteration. The uraninite from the Flat Rock mine has lately been

analyzed by W. F. Hillebrand in the laboratory of the U. S. Geological Survey, as follows:

Uranic oxide.....	50.83
Uranous oxide.....	39.31
Thoria.....	2.78
Cerous oxide.....	0.26
Lanthana and didymia.....	0.50
Erbia and yttria.....	0.20
Lead oxide.....	4.20
Ferrous oxide.....	trace
Lime.....	0.85
Magnesia and alkalies.....	0.30
Water.....	1.21
Silica.....	0.08
Phosphoric acid.....	?
Nitrogen.....	0.37
Insoluble.....	0.10
	100.99

Sp. gr., 9.086.

The material, which was received from Mr. W. E. Hidden, was slightly altered, containing minute crevices filled with gummite.

RUTILE.

In beautiful crystals at Crowder's and Clubb's Mountains, Gaston County; also granular at the same localities; rarely in small grains or crystals with the corundum of the Culsagee mine in Macon County and the Hogback mine in Jackson County; in acicular crystals, sometimes over 1 inch in length, near Beattie's Ford, Mecklenburg County; in long crystals in quartz on a hill near Buckhorn Falls, in Chatham County, at the head of Cane Creek, Mitchell County; in beautiful acicular crystals at Mrs. Daniel's farm near Mount Pisgah, at Mrs. Jordan's near King's mill, at Alex. Lackley's, Misses Bennett's, Thomas Adams's, and Mrs. Smith's farm, all in Iredell County; acicular crystals in limonite and quartz on John Lackey's farm near Liberty Church, and Wilson's near Poplar Springs; geniculated crystals at White Plains, at Crouch's, and at Milholland's mills, all in Alexander County. The first-named locality furnishes the most magnificent crystals, sometimes 3 or 4 inches in length, fully developed, with numerous brilliant planes, often geniculated and transparent, with a beautiful red color. According to Hidden, Alexander County must be credited with having produced the most beautiful rutile crystals known to science. He says:

Rutile is found there in a similar situation to the gems and quartz crystals, i. e., in open pockets; in fact, it is found intimately associated with and implanted upon the gems, and often preponderates over all the other crystal contents. The particular points of difference over the same product from other regions are their mode of occurrence, beautiful natural polish, and crystallographic features. Their color ranges from jet black to clear ruby red and pale yellow. They range from those of minute sizes to rare examples 3 inches long and one-half inch diameter. Their luster in some

cases approaches that of polished steel. Gems have been cut from the most solid crystals and the result compares favorably with the rare black diamonds from Brazil. Only experts could tell them apart.

Curiously jointed, mitered, and reticulated crystals and also masses of crystals thus united have been commonly met with; all of which are found to follow certain arbitrary twinning laws and are not accidentally brought together into such strange shapes as a cursory examination might seem to indicate.

This description applies in particular to crystals found in or near the emerald and hiddenite mine. Rutile is also abundant in coarse crystals near Bryson City, Swain County; in acicular crystals in brownish amethyst, at the head of Honey Creek, Wilkes County; in dark, almost black, crystals in Clay County; in quartz in Yancey County; in small grains and crystals in the gold sands of Burke, McDowell, Rutherford, and Polk Counties; acicular crystals in quartz at Dietz's, Van Horn's, and Hildebrand's, and in large crystals also at the latter point, Burke County; in large crystals at E. Balch's, H. Balch's, Widow Balch's, Huffman's, and D. Lutz's, and in amethyst at the last two points—all in Catawba County; in amethyst in Cabarrus near Concord, and in Randolph near Pilot Mountain; penetrating corundum near Bakersville, Mitchell County; at Ray's mine, and elsewhere in Yancey County; in reticulated acicular crystals in the northwest corner of Lincoln County (Hunter).

Under the name of edisonite, Hidden describes a supposed fourth form of titanite oxide from the Whistnant gold mine in Polk County. It has been shown by Mügge to be only a variety of rutile.

ANATASE.

Anatase has been found in small, brilliant, tabular crystals, in the gold sands of Burke County, by myself and Mr. Hidden. The latter also reports it from Alexander County, in quartz, and from McDowell and Rutherford Counties. At Brindletown, in Burke County, the crystals were of unusual size; some were highly modified, and a few were transparent and glassy, and of a pale green or blue color.

BROOKITE.

In the gold sands of Rutherford, McDowell, and Burke Counties, brookite occurs in small, short, slender, rhombic prisms. At Brindletown Hidden found it varying in color from dull yellow to brown, a few crystals being of a fine red with highly modified terminations.

PYROLUSITE.

It is found near Murphy, Cherokee County; also 2 miles north of Hickory, Catawba County, and with silver ores at the McMakin mine, Cabarrus County; also in fine crystalline masses at Beck's ore bank, 3 miles from Ellison's ore bank, Gaston County; near Danbury, Stokes County; near Webster, Jackson County; in Surry County, near Dob-

son; and in Alexander, Swain, and Mitchell. No large deposits have yet been discovered in North Carolina.

BRAUNITE (?).

Found in quartz near Hillsboro, Orange County. K.

HAUSMANNITE (?).

Recently reported from near Dobson, Surry County, by H. O. Lewis; and it also occurs in Chatham. K.

DIASPORE.

Gen. Clingman observed this rare mineral associated with blue corundum from near Marshall, Madison County. I have not been able to distinguish it with certainty from any other of the corundum localities, but it was observed in very minute but beautiful acicular crystals of the usual form in a cavity of massive corundum from Culsagee, by John C. Trautwine, of Philadelphia.

GOETHITE AND LIMONITE.

I put these two species of hydrated sesquioxide of iron together, as without fuller examination it is impossible to distinguish the majority of the specimens. Large beds of hydrated sesquioxide of iron are found at Ore Hill and elsewhere in Chatham County, and in Johnston, 5 miles west and northwest of Smithfield; near the High Shoals, in Gaston County; in Lincoln and Catawba Counties; near Murphy and along Valley River and Notteley, in Cherokee; in Mitchell, Buncombe, Watauga, McDowell, Burke, Caldwell, Alexander, Wilkes, Surry, Haywood, Macon, Henderson, Transylvania, Davidson, Wake, and other counties; and superficial beds of it are also frequently found in the eastern counties—Nash, New Hanover, Pender, Jones, Duplin, etc. Brown hematites accompany in small quantities many of the magnetite and hematite beds, and form the upper part of many of the gold and copper mines; they are often the result of the alteration of siderite and pyrite, and show frequently the form of the original mineral: for instance, at Conrad Hill, in Davidson County; Cabarrus County, Guilford County, Gaston County, and at Beam's farm, near Center Point, Iredell County.

GUMMITE.

Discovered by Prof. Kerr in 1877, at Flat Rock, Mitchell County. Sometimes found in distinct cubical crystals with octahedral planes, usually in amorphous, compact, nodular masses of a faint resinous luster and of shades between reddish yellow and deep orange red. Fracture uneven to subconchoidal. Sp. gr. 4.840. The mean of three analyses which I have made gives its composition as follows:

Silica	4.63
Alumina	0.53
Baryta	0.98
Strontia	0.05
Lime	2.05
Plumbic oxide	5.57
Uranic oxide	75.20
Phosphoric acid	0.12
Water	10.54
	99.77

These analyses show that the so-called gummite is *not* a distinct mineral species but a mechanical mixture, the North Carolina variety being—

	Per cent.
Uranic hydrate	40.10
Uranotil	33.38
Lead uranate	22.66
Barium uranate	4.26
	100.40

Results from the alteration of uraninite. Found also at the Deake and Lewis mines, Mitchell County. A similar mineral is found in small quantity at Buchanan mine, Mitchell County.

The largest mass of gummite with uraninite found in the State weighed 6 pounds 6 ounces. The nodules often contain black uraninite at the center.

PSILOMELANE.

It is often an associate of gold and iron ores in coatings of the quartz at Scott's Hill, Burke County, together with pyrolusite at Beck's ore bank, on the High Shoals, Gaston County, and in botryoidal masses in a vein, said to be 4 feet wide, near Lenoir, in Caldwell County, near Bakersville, at Gillespie's Gap, in Mitchell County, on Cove Creek, and Richmond Creek, Haywood County, and at Buckhorn in Chatham. In Gaston County at the Long Creek mine, on Cross Mountain, Ormond ore bank, etc., a variety occurs, which contains a small quantity of cobalt and nickel. Also found in McDowell and Lincoln Counties.

WAD.

There is often an imperceptible change from pyrolusite into psilomelane and wad, so that, without analysis, it is often difficult to know to which a specimen may belong. The earthy varieties are generally called wad. A brownish black, earthy wad occurs near Murphy, Cherokee County, also near Franklin, in Macon County, and Webster, in Jackson County, at Gillespie Gap, Mitchell, in Burke, Catawba, Surry and Mecklenburg, and at the Ormond ore bank in Gaston County.

SENARMONTITE OR VALENTINITE.

The incrustation upon the native antimony of Burke County, which does not show any crystalline planes, belongs to either one or the other of these species.

BISMITE.

An earthy, greenish yellow and straw yellow mineral has been observed at the King's Mountain mine and the Asbury vein in Gaston County. It is probably bismite.

MOLYBDITE.

Found associated with molybdenite as a yellow, earthy powder, near Pioneer Mills, Cabarrus County.

QUARTZ.

As a constituent of most of the rocks of North Carolina, and the gangue rock of almost every vein, it occurs nearly everywhere throughout the State. Several of its varieties, however, are of more than usual interest. Rock crystal is found in numerous most beautifully modified forms on the farms of the Lackey family and others near Mahoffey's mill, Alexander County. These have been the subject of a highly important crystallographic investigation by Prof. Gerhard vom Rath, of Bonn. Unusually large masses of rock crystal from near Jefferson, Ashe County, were sent to New York in 1887. One perfect crystal weighed 20½ pounds; another crystal weighed 188 pounds, and a third weighed 285 pounds. The last named was 29 inches long, 18 wide, and 13 thick. Some of the masses found would yield perfectly pellucid crystal balls of 5 inches in diameter. This occurrence has been described by G. F. Kunz.

Good doubly terminated crystals occur at Sugar Mountain, Burke County. Rock crystals are also found in Rutherford County; near Morganton, Burke County; near Hickory, Caldwell County; Catawba County, Iredell County; Mountain mine, in Cleveland County; at Hampton's, on Mining Creek, Yancey County; Stokesburg, in Stokes County; Macon County, Swain County, Rich Mountain, head of Cove Creek, in Watauga County; Mitchell and Transylvania, in Wilkes, Guilford, Lincoln, Gaston, Burke, Anson, Granville, Wake, Moore, Warren, and other counties. Quartz crystals, inclosing liquid (hydrolite, Humphreys), in beautiful specimens, are found on Isaac Price's farm, White Plains, Alexander County, also found by Prof. Humphreys, in pockets and drift veins in Catawba County, and in the South Mountains, Burke County, one with a bubble which moves nearly 2 inches, and a group of 13 crystals having 50 bubbles. He also found crystals with the basal plane in Burke, Catawba, and Alexander Counties. At the emerald locality, in Alexander County, some 7 years ago, Mr. Hidden discovered a remarkable "pocket" which yielded over 400 pounds of crystals,

many of them containing water bubbles of unusual size. Nearly all of these were destroyed by freezing, which shattered the crystals to fragments. Rutilated quartz crystals of great beauty are met with at several localities in Randolph, Catawba, Burke, Iredell, and Alexander Counties (enumerated under Rutile). Quartz crystals with scaly crystals of hematite occur at King's Mill, Iredell County. Quartz between laminae of muscovite, occurs at the Deake mine, on Toe River, Mitchell County. Radiated quartz is found at Dillahay's gold mine, in Person County and in Wake County. Amethyst, in very fine crystals and clusters of crystals, and of a good violet or pink color, but mostly of a dark, smoky color, is found at Randleman's, Lincoln County, also at the lead mine, Alexander County, at Hickory, Catawba County, in Rutherford, Chatham, and Wake Counties; amethyst of a deep purple color with rutile occurs in Catawba County, and a smoky amethyst with rutile, at the head of Honey Creek, Wilkes County. Rose quartz is found at Highlands, in Macon, near Franklinville, in Randolph (with acicular rutile), White Plains, Alexander County, and near Concord, Cabarrus County, likewise penetrated with rutile. Smoky quartz is found 3 miles from Taylorsville, Alexander County, on Cavin's and also on Pritchard's and Patterson's farms; it also occurs in large crystals on Brush Creek, Mitchell County, in the drift of Brindletown, Burke County, at the mouth of Beaver Dam Creek, Cherokee County, and in Alleghany County.

Milky quartz is found at Roseman's farm, Alexander County, at the forks of the Laurel, Madison County, and at War Hill, Surry County; opalescent quartz at Dan River, Stokes County. Quartz pseudomorphous after calcite, both crystallized and fibrous, is found 2 or 3 miles northwest of Rutherfordton, Rutherford County; the irregularly shaped fragments frequently contain water. Similar pseudomorphs occur at Crawford's farm, 5 miles east of Statesville, in Iredell County; and a peculiar variety of pseudomorphous quartz, after feldspar perhaps, occurs at Shooting Creek, Clay County. Concerning the quartz at Crawford's farm, Hidden says:

From a careful study of the rock in situ and of many specimens from the localities, I am forced to conclude that these forms of quartz are pseudomorphs of the interstices between crystals of some mineral that crystallized in thin, flat, tabular forms.

Sections of these water-bearing forms present an interior of bright transparent crystals, or of mammillary chalcedony, while the structure of the walls is semi-radiated from the exterior. Careful examination of the surfaces shows a series of triangular markings (angles 60°) on all sides. Now these markings are exactly what we would expect by the slow deposition of quartz on the basal pinacoid of a uniaxial crystal (rhombohedral), or of the deposition of quartz from solution in a vein filled up with meshed and netted crystals, which being thin, presented only basal planes for contact surfaces. What the original mineral was is not shown by the specimens. The casts of crystal cavities in the larger masses show an unmistakable hexagonal prism with a large development of the basal pinacoid (these two planes identified by striations on the quartz), and this characteristic is persistent.

Chalcedony is found near Franklin, Macon County; near Webster, Jackson County; at Hampton's Mining Creek, Yancey County; at

Martin's limestone quarries, in Stokes County; on Alamance Creek, Alamance County; and in Lincoln, Iredell, and Chatham Counties. Hornstone occurs at Martin's quarry, Stokes County; near Asheville, Buncombe County; in Madison County and Iredell County; and in Montgomery, Randolph, and elsewhere. Drusy quartz is frequently found on the decomposed outcrops of the chrysolite beds in Macon, Jackson, Clay, Buncombe, and Madison Counties. Itacolumite or flexible sandstone forms a stratum in the quartzite at Linville, Burke County; Sauratown Mountains, in Stokes County, and Bending Rock Mountain, in Wilkes County. Fossil wood is abundant in the Triassic beds in Anson County, and near Germanton, in Stokes County; near Ocheek's Creek, in Montgomery County, and in Johnston County; and in the quaternary gravels of Halifax, Moore, Cumberland, Wayne, and other counties. Agate is found in many places; at D. Caldwell's, Mecklenburg County; near Harrisburg and near Concord, Cabarrus County; in Granville, Orange, and elsewhere. Jasper occurs banded (red and black) in Person County, in Granville (Knap of Reeds Creek), in Madison County (near Warm Springs and on Shut In Creek), in Moore County, in Wake, and elsewhere.

A peculiar purplish brown variety of quartz from Uwharie, Montgomery County, partially analyzed by me, gave:

Ignition	0.70
Silica	91.53
Ferric oxide	5.16
Magnesia	0.14
Lime	0.66
Undetermined	1.81

100.00

Sp gr., 2.663.

OPAL.

The only variety of opal which has come to my notice from North Carolina is "hyalite" in bluish white mammillary coatings upon the quartz of gold veins in Cabarrus County, and at the Culsagee mine, Macon County. It is rarely found in beautiful, colorless, and white botryoidal incrustations upon foliated chlorite. A peculiar yellowish to brownish hyalite, incrusting quartz, was collected by F. W. Clarke in 1883, at Foster's mica mine, near Jefferson, Ashe County.

TERNARY OXYGEN COMPOUNDS.

SILICATES.

ANHYDROUS SILICATES.

ENSTATITE.

Forms beds at the corundum mine of Culsagee, in Macon County, in coarsely crystalline masses of a brownish gray, yellowish color; in coarsely granular masses with chrysolite, at Webster, Jackson County;

also in small crystalline particles, disseminated through chrysolite, at Hampton's, Mining Creek, Yancey County, and $2\frac{1}{2}$ miles south of Bakersville, in Mitchell County. Bronzite is found at Bald Creek, Yancey County, and near Kernersville, Forsyth County. I had this mineral from the Culsagee mine analyzed in the laboratory of the University of Pennsylvania by Frank Julian, who found:

Water	1.21
Silica	57.30
Alumina	trace
Ferrous oxide	7.45
Magnesia	34.64
	100.60

PYROXENE.

Black and brownish black, cleavable masses, with magnetite, at Cranberry, Mitchell County, and of pale greenish color, with magnetite, on Ivy River, Madison County, and on Horse Creek, Ashe County; in "traps" at Greensboro, Guilford County; green coccolite, in calcite, 2 or 3 miles from the mouth of Bear Creek, in marble, at Walnut Creek, 1 mile from French Broad River, Madison County, and at Goshen, Macon, County. Dark brownish black and black pyroxene is one of the constant constituents of the numerous "trap" rocks found in North Carolina.

SPODUMENE.

Occurs in Sharpe's Township, in Alexander County. The first crystals obtained were pale yellowish green, and were thought to be diopside. They had been found loose in the surface soil by some children living on a farm near Salem Church, and were shown to Mr. William Earl Hidden by Mr. J. A. D. Stephenson, of Statesville. The former gentleman sent specimens to Dr. J. Lawrence Smith, who, by analysis, proved them to be spodumene. The mineral has since been extensively mined under the direction of Mr. Hidden; and the new emerald green variety of spodumene has received the name of hiddenite. As a gem it ranks equal in beauty and value to the emerald, which latter stone occurs with the hiddenite. In color it ranges from fine emerald green through yellow to nearly white. It occurs almost invariably implanted upon the walls of open pockets, associated with a number of other minerals of considerable beauty. The emerald green variety has been analyzed by Dr. J. L. Smith (I) and myself (II), as follows:

	I.	II.
Sp. gr.	3.14	3.166
Silica	64.5	63.95
Alumina	27.0	26.58
Chromic oxide		0.18
Ferrous oxide	1.9	1.11
Lithia	7.5	6.82
Soda		1.54
Potash		0.07
	100.9	100.25

The sp. gr. of the yellowish hiddenite I found to be 3.177; that of the darkest green variety was determined by Smith to be 3.191 to 3.194.

AMPHIBOLE.

Amphibole is represented in North Carolina by numerous varieties. We find white and gray tremolite associated with talc at Marble Creek and Murphy, Cherokee County; also on the Tennessee Creek, Jackson County, in talc and chrysolite; at Webster, Jackson County; the Whiteside Mountains, Sugartown, 8½ miles from Franklin; at the Culsagee mine, Macon County, 2½ miles south of Bakersville, in Mitchell County; at Hampton's Mining Creek, Yancey County; on Toe River; at the Carter mine, Madison County; gap of Black Mountain, and the southeast slope of Three Top Mountain, in Ashe County. Gray and brownish grammatite occurs near the Tennessee Creek; anthophyllite occurs at Culsagee mine and at Gregory Hill, in Macon County; actinolite has been observed in talc near Belt's Bridge, Iredell County; at Shooting Creek, Clay County; Swannanoa River, near Asheville; and with chrysolite at Webster, Jackson County; Hampton's Mining Creek, in Yancey County, 2½ miles south of Bakersville, Mitchell County; in talcose rocks near Tennessee Creek, on the East Fork of Tuckasee 1½ miles from its mouth, Mecklenburg County; Rich Mountain, Watauga County; Franklin, in Macon County; at Bolejack's limestone quarry, in Stokes County; at Rogers's ore bank, near Danbury, in Stokes County; near Morganton, Burke County; and Ellison's, in Gaston County. Asbestos has been found at Webster, and at the head of Cullowhee Creek, Jackson County; on Sugartown Creek, near Franklin; at the Nantehaleh River, in Macon County; the Brushy Mountains; at Baker mine and on John's River and on King's Creek, Caldwell County; and on Smith's River, Rockingham County, in Franklin and Wilkes Counties; at Hampton's Mining Creek, in Yancey County; at Buchanan's and Cane Creek, near Bakersville, in Mitchell County; also in quartz crystals at J. W. Warren's farm, White Plain's, Alexander County. Black and greenish black hornblende is abundant throughout the State in the hornblende slates, hornblende rocks, syenite, and diorite. It has been found in rather large cleavage pieces 23 miles below Franklin, on the Swannanoa River, near Asheville; at the Cullowhee and Savan-

nah mines, in Jackson County; at Jarrett's, on the Nantehaleh, in Cherokee County; and at Polecat Creek and near Greensborough, in Guilford County.

True orthorhombic anthophyllite, well crystallized and transparent, has been described by Penfield from the Jenks corundum mine at Franklin, Macon County. Sp. gr. 3.093. Analysis (Penfield) as follows:

Silica	57.98
Ferrous oxide	10.39
Manganese oxide	0.31
Magnesia	28.69
Lime	0.20
Alumina	0.63
Water	11.67
Loss at 100	0.12
	99.99

SMARAGDITE (?); KOKSCHAROWITE.

A beautiful mineral, which may be a variety of hornblende, occurs at the Cullakenee mine, Clay County. It has a bright color between emerald and grass green, gradually passing into grayish green and greenish gray. Sp. gr. of the grass-green variety, 3.120. It is associated with pink and ruby corundum and a feldspathic mineral. The analysis of the pure material gave Thomas M. Chatard—

Silica	45.14
Alumina	17.59
Chromic oxide	0.79
Ferrous oxide	3.45
Nickelous oxide	0.21
Magnesia	16.69
Lime	12.51
Soda	2.25
Potash	0.36
Ignition (water)	1.34
	100.33

ARFVEDSONITE.

A brownish black or greenish black hornblende-like mineral, is found associated with the andesite, zoisite, and corundum of the Cullowhee mine and Shooting Creek, Clay County, and rarely at Culsagee, Macon County. It is easily fusible and gives a strong yellow flame, and is therefore probably arfvedsonite. An analysis of a black variety by J. L. Smith places it rather under the aluminous hornblende. He found:

Silica	45.90
Alumina	13.34
Ferric oxide	11.46
Lime	12.20
Magnesia	12.53
Soda	3.39
Water	0.66

99.48

CROCIDOLITE (?)

This mineral I have received from Col. Joseph Willcox, and it is said to come from one of the western counties of North Carolina. The physical properties and the chemical tests which I have made indicate that it is crocidolite. It consists of long, delicate fibers of a blue color, is insoluble in acids, and fuses easily to a black glass, coloring the flame yellow.

BERYL.

Found in six-sided prisms, sometimes doubly terminated, from about half an inch to 4 inches in thickness, and from 1 to 6 inches in length; color yellowish and bluish green, small pieces of the latter color sometimes transparent enough to be cut for gems (aquamarine), associated with orthoclase, muscovite, tourmaline, etc., at Ray's mine, on Hurricane Mountain, Yancey County. Yellowish green crystals have been found at Buchanan mica mine, and elsewhere in Mitchell County. Clear green crystals occur at Balsam Gap mine, Buncombe County. Found also at the Carter mine, Madison County; Thorn Mountain mine, Macon; Casher's Valley, Jackson; on Green River, Henderson County; at E. Balch's, Catawba; Fort Defiance, Caldwell; at Well's, Gaston County. Some very large crystals were found (one 2 feet long and 7 inches in diameter), 4 miles south of Bakersville, and at Grassy Creek mine of still larger size. Green crystals appear at Point Pizzle mine and elsewhere in this county, and on Green River, Henderson County. The most beautiful varieties, similar to occurrences in Siberia, are found in Sharpe's Township, near Salem Church, at White Plains, Alexander County, also in pale green or bluish green modified hexagonal prisms and pale bluish crystals. This is the locality of the emerald and hiddenite mine, and here for 8 years past have been found most magnificent crystals of emerald as regards color, perfection of form, and crystallographic interest. Beryl in yellowish green, hexagonal prisms is also found at Lackey's farm, near Liberty Church, and Isaac Price's farm, White Plains, Alexander County. It also occurs in yellowish green crystals in Catawba County; one bluish green, transparent crystal, implanted in quartz, has been found at Capt. Mills's gold mine, in Burke County, and another of 1 inch diameter and 4 inches length, with a tourmaline crystal of the same length embedded in it. In greenish yellow and deep green crystals, similar to Siberian, in the South Mountains, 9 miles southeast of Morganton, Burke County, and in the Sugar Mountains; also at Shoup's Ford, at Dietz's, Huffman's, and Hildebrand's. In smaller crystals it is found in Jackson County.

I have analyzed a rounded, waterworn, greenish pebble of beryl exhibiting an uncommonly perfect basal cleavage (for this species) from Alexander County, with the following results:

Silica.....	66.28
Alumina	18.60
Glucina.....	13.61
Ferrous oxide.....	0.22
Alkalies.....	undet.
Ignition	0.83
	99.54

Sp. gr., 2.703.

CHRYsolITE.

This is one of the most interesting minerals of North Carolina, where it forms large beds between the hornblende and granite rocks. It is unnecessarily called dunyte, from the Dun Mountains in New Zealand, where it occurs under like circumstances. It is generally of a yellowish green color, but also greenish white, gray, and brownish green, mostly finely granular, rarely foliated, occasionally in larger grains disseminated through the fine-grained mass. Associated with chromite, enstatite, actinolite, tremolite, asbestos, talc, chromite, and corundum, at Culsagee mine, near Franklin, Macon County; in Haywood County; near Webster and Hogback, in Jackson County; at Bald Creek and at Hampton's, Jack's Creek, and South Toe River, 7 miles from Burnsville, Yancey County; $2\frac{1}{2}$ miles south of Bakersville, in Mitchell County, at Shooting Creek and Cullakenee mine, Olay County; at Rich Mountain, Watauga County; at the Carter mine, in Madison County; on Ivy, Buncombe County; near the forks of New River, Ashe County; on Little River, Alleghany County; and 4 miles south of Morganton, Burke County. It is also found with bronzite, in hornblende rock, in Guilford County, and near Raleigh, Wake County. I have analyzed two specimens from Webster, Jackson County, one (I) which was finely granular and of a pale greenish color, with a sp. gr., 3.280, the other (II) of a yellowish olive green color, and 3.252 sp. gr., and Thomas M. Chatard one from the Culsagee mine (III):

	I.	II.	III.
Loss by ignition.....	0.82	0.76	1.72
Chromite	0.58	1.83	.....
Silica	41.89	40.74	41.58
Alumina.....	trace.	trace.	0.14
Ferrous oxide.....	7.39	7.26	7.49
Nickelous.....	0.35	0.39	0.34
Magnesia	49.13	49.18	49.28
Lime.....	0.06	0.02	0.11
	100.22	100.18	100.66

The chrysolite is subject to extensive alterations, forming serpentine and talc with their usual associates.

GARNET.

Widely distributed through the State, and a constant constituent of many of the mica and hornblende slates, in which it occurs in minute dodecahedral and trapezohedral crystals of a brownish or brownish red color; it also occurs in many of the talcosé and chloritic slates; larger trapezohedral crystals of a brownish red color, and sometimes almost black, are frequently met with in the mica mines of Mitchell and Yancey counties; imperfect dodecahedral crystals at Weaver's, Jeanstown, Rutherford County, and in talcose slate, in Rockingham, Cherokee, Madison, Surry, and many other counties. The most beautiful and perfect crystals are large trapezohedra, of a brownish red color, from Burke, Caldwell, and Catawba counties. A very excellent locality is about 8 miles southeast of Morganton, in Burke County, where very bright red crystals are found, some weighing nearly 10 pounds. Several tons of garnet from this locality have been crushed into different grades of fineness and sent to market for the manufacture of "sand-paper."

Another good location is 4 miles from Marshall, where large crystals are found embedded in chlorite slate. Some of these garnets are nearly transparent, and when cut show a peculiar play of colors.

In Alexander County, on Marshall's farm and elsewhere, garnets are found several inches in diameter. Large crystals and crystalline masses of a reddish brown garnet are found near Franklin, Macon County, and on Toe River, Mitchell County. Of good red color it has been observed in the sands from gold washings in Burke, McDowell and Warren counties. The massive manganese garnet or spessartite is abundant at Jeanstown, Rutherford County; at Buckhorn, Chatham County; near Moore's mills, Stokes County; near Gold Hill, in Cabarrus County; near Brevard's forge, $1\frac{1}{2}$ miles from the Vesuvius furnace; near Macpelah church, Lincoln County; near the High Shoals, and at Clubb's Mountain and Crowder's Mountain, Gaston County; near Madison, Rockingham County; near Salem, Forsythe County; on Horse Creek, Ashe County; Linville Mountains and Bridgewater, Burke County; in Guilford County; at Thorn Mountain mine, Macon County; near Marion, McDowell County; at Buchanan mine, Mitchell County; on Pacolet River, Polk County; at Weaver's, Rutherford County, and near Dobson, Surry County.

Mr. G. A. Koenig has analyzed a variety of manganese garnet or spessartite from Yancey County (I), and I that from near Salem, Forsyth County (II), which contain:

	I.	II.
Silicia	35.80	36.74
Alumina	19.06	16.55
Ferric oxide	6.25	undet.
Manganous oxide	28.64	25.80
Ferrous oxide	4.49	14.26
Magnesia	0.60	2.56
Lime		4.09
Sp. gr., 4-14.	99.84	100.00

ZIRCON.

Abundant with the gold sands of Burke, McDowell, Polk, Rutherford, Caldwell, Mecklenburg, Nash, Warren, and other counties, in very minute yellowish brown and brownish white, sometimes amethystine and pink crystals with many planes; large grayish brown crystals of zircons are found so abundant on the south side of the Blue Ridge near Green River, Henderson County, that Gen. Clingman easily obtained in a few weeks in 1869, 1,000 pounds of crystals. More recently, a commercial demand for zircons having arisen, over 30 tons of the mineral have been taken from this region. It is found here embedded in feldspathic gneiss, and also in a similar association at the Jones's mine, near Coleman's station. Found also by Dr. Hunter at Well's farm, Gaston County. It is rarely found at Ray's mine, Hurricane Mountain, Yancey County, and the Flat Rock mine, Mitchell County. It has been observed in dark red brown crystals in the magnetite beds of the Unaka Mountains; an irregular large crystal of about 2 inches in length and a pale brownish gray color has been found by J. A. D. Stephenson near Statesville, Iredell County; and by the same, small crystals embedded in allanite, near Bethany church.

Peculiar dark brown crystals from 1-3mm. in size are found at Low's and Tibbet's mine, in Macon County, which may be zircon. They need fuller investigation. Hidden reports, from the gold sands of Brindletown, good crystals of the variety malacone. The latter are jet black, with occasionally a grayish crust, and are larger than, and of different form from, the zircons directly associated with them. Sp. gr. 4.087. The same authority reports the variety cyrtolite from several places, namely:

Masses and distinct crystals having curved faces and gray brown color have been met with at the Wiseman mica mine in Mitchell County, associated with autunite, fergusonite, and samarskite. Also at Mill's mine, near Brindletown, and at the xenotime and polycrase locality on the Davis land, near Green River, in Henderson County.

With the monazite at Mars Hill, Madison County, zircon crystals of considerable size are sometimes found. One such crystal, sp. gr. 4.507, was analyzed by me as follows:

Loss on ignition.....	1.20
Silica	31.83
Zirconia	63.42
Ferric oxide	3.23
	99.68

VESUVIANITE.

A mineral resembling vesuvianite occurs in brownish green, indistinct, crystalline masses, intermixed with quartz, and associated with reddish brown garnet, in Macon County.

EPIDOTE.

Epidote is found abundantly in North Carolina, although fine crystals are exceedingly rare. The finest specimen which I have seen, is a crystal, in the cabinet of the University of Pennsylvania, from the gold washings of Rutherford County; it is strongly pleochroic, like the so-called "Puschkinite," from the auriferous sands of Katharinenburg, in the Ural Mountains. Fine crystals have been lately obtained by Hidden, at Hampton's, Yancey County. Yellowish and brownish green crystalline masses, sometimes with indistinct crystals, have been found near White's mill, Gaston County, and near Franklin, in Macon County. At the latter place occurs also a variety in short, stout crystals of a dark brown or greenish brown color (analysis below). In Mitchell County it is found in dark brownish green crystals and radiating masses. Crystals and crystalline masses in quartz at White Plains, Alexander County. Fragments of epidote in greenish crystals, also a granular variety, are frequently met with in the gold sands of Burke, McDowell, and Rutherford Counties.

Epidote of olive green or grayish and brownish green color occurs massive as a frequent admixture of hornblende slate (notably in Mitchell County) or diorite, sometimes forming pure masses of epidote, as at the foot of Grandfather Mountain, head of Watauga River, Watauga County. It occurs also abundantly and conspicuously, as bright green amygdules in the chloritic amygdaloidal gneisses on Watauga River. It constitutes, with a reddish feldspar, the so-called unakyte rock, which may be seen at Marshall, Madison County, and down the French Broad in occasional seams and thin beds for several miles. It has also been found in many of the magnetic iron ore beds, as at Cranberry, Mitchell County; at Smith's ore bed on Ivy, Madison County, in the beds on Horse Creek, Ashe County, at Buckhorn, Chatham County, etc.

I have analyzed the brown epidote from Macon County, and found the sp. gr. 3.269, and its composition:

Silica	36.95
Alumina	25.82
Ferric oxide	9.97
Ferrous oxide	1.34
Manganous oxide	0.56
Magnesia	0.56
Lime	21.86
Ignition (water).....	3.02
	100.08

ALLANITE.

Allanite is found in jet black or brownish black, slender crystals, sometimes of 6 to 12 inches in length, and also in crystalline masses in a granite vein at Balsam Gap, Buncombe County. Also under similar circumstances at the Buchanan mine and Wiseman's mine, Mitchell

County, in unusually perfect crystals 2cm. long by 1cm. thick. At the Hiddenite mine it occurs in small, well polished prisms. In massive form it occurs near Bethany church, Iredell County, in large quantities, with small crystals of zircon imbedded in it.

Another promising locality is near Democrat P. O., Madison County. It has also been identified by Hidden among the minerals from Brindletown, and from the Henderson County zircon mines. At some of the localities the allanite undergoes an alteration and changes into a pale brownish or brownish yellow mineral which has not been further examined. A mineral of an orange color from the Buchanan mine, resembling gummite, may be the so-called yttro-gummite; the quantity at hand was too small and impure for analysis, but it contains uranic oxide and some of the rare earths of the cerium or yttrium groups.

I have analyzed the allanite from Balsam Gap (I), and the Hiddenite mine (II); Dr. J. W. Mallet has examined the pitchy black variety from Wiseman's mine (III), and Mr. Harry F. Keller that from Bethany Church (IV). The analyses are as follows:

	I.	II.	III.	IV.
Sp. gr.....	3.400	3.005	.....	3.63
Silica	32.79	32.05	39.03	31.685
Alumina.....	18.16	22.93	14.33	17.330
Ferrio oxide.....	1.64	11.04	7.10	7.052
Ferrous oxide	10.08	.....	5.22	.....
Cerium oxide.....	6.07	.....	.....	10.110
Didymium oxide.....	14.40	14.81	1.53	18.990
Lanthanum oxide.....				
Yttrium oxide.....	1.84	0.85	8.20	1.120
Erbium oxide.....				
Manganese oxide	1.23	1.99	trace.	1.025
Magnesia.....	0.15	1.28	4.29	0.540
Lime	10.95	9.43	17.47	10.785
Soda.....	0.33	0.54	.....	0.210
Potash.....	0.12	0.20	.....	trace.
Water.....	1.89	3.64	2.78	1.460
	99.75	98.76	99.95	100.307

ZOISITE.

The beautiful variety of zoisite, "thulite," has been found in slender, rose-red crystals in the feldspars at the Flat Rock mine, Mitchell County. At the Cullakenee mine it is found as one of the products of the alteration of corundum. Some of the pink as well as the bluish gray corundum is changed into compact and cleavable columnar masses of zoisite of a grayish, greenish, and brownish white color. G. A. Koenig has analyzed the slightly greenish white cleavable variety (I), which has resulted from the alteration of pink corundum. I have made an analysis

of the white, slightly grayish zoisite (II), containing still nuclei of unaltered bluish gray corundum:

	I.	II.
Sp. gr.....	3.286	3.224
Silica	40.70	39.86
Alumina	33.86	33.84
Ferric oxide	0.81	1.62
Manganous oxide.....	trace.	trace.
Magnesia	0.22	0.18
Lime	24.05	23.82
Soda (trace of lithia).....	undet.	0.22
Potash	undet.	0.09
Loss by ignition	0.63	0.78
	100.27	100.41

Some 40 years ago, about half a mile southwest of Silver Hill, while searching for the continuation of the vein, a grayish white, foliated and columnar mineral was found which had the appearance of zoisite. No further examination of it was made, and there is probably no specimen preserved. Dr. Hunter reports zoisite from Alleghany County, and it also occurs in Swain County.

PHLOGOPITE.

Small brownish scales of it have been found in the granular limestone of Bolejack's quarry, near Germantown, and at Martin's quarry on Snow Creek, Stokes County, on Walnut Creek, one mile from the French Broad River, in Madison County, on Valley River, in Cherokee County, and at Judge Pearson's, near the Yadkin River, Yadkin County. It is found also near Coleman's Station, in Henderson County.

BIOTITE.

Biotite is a constituent of many of the granites, gneisses, and mica schists of North Carolina. It is found only in small black or brownish black plates or scales. The localities are too numerous for particular mention. It occurs in large plates and in very regular crystals in the mica mines of Mitchell, Haywood, Yancey and especially Macomb, notably at Lytle and Thorn Mountain mines.

MUSCOVITE.

The mica of the gneiss and mica schist is mostly muscovite, hence it is one of the commonest minerals of North Carolina. In a few localities it is found in beautiful crystals, for instance, with magnetite at Buckhorn, in Chatham County, with quartz, at Hickory, Catawba County, and with pyrite, in Stokes County. The most remarkable crystals of muscovite are associated with the minerals of the Emerald and Hiddenite mine in Alexander County. They are hexagonal plates implanted edgewise on the walls of pockets, and are dusted over with a chloritic coating, possibly of hisingerite (q. v.), which gives the mica

a peculiar bronzy appearance. An analysis by *F. W. Clarke* is given below.

Since the year 1868 mica has been mined in many places and has been obtained in large plates, at times over 3 feet in diameter, generally of a brownish color, in masses or large crystals, associated with gray, smoky, or yellowish brown quartz, orthoclase, albite, etc., in numerous localities in Macon, Jackson, Haywood, Buncombe, Ashe, McDowell, Mitchell, Yancey, Alexander, Cleveland, and other counties. A pink colored muscovite in fine scales, much resembling lepidolite, for which it was mistaken, occurs with mica at Ray's, mine in Yancey County, and at the Flat Rock mine in Mitchell County.

A compact variety of this species, often in very fine cryptocrystalline scales or fibrous, radiating masses, frequently resulting from the alteration of corundum and other minerals, was formerly, under the impression that it was distinct hydrous mineral, designated as damourite.

Very fine white and yellowish white pearly scales are found with the cyanite at Crowder's and Clubb's mountains, which result from alteration of the cyanite. Under similar circumstances it is found in Yancey, Cherokee, and Iredell counties. A slaty variety, much resembling the pyrophyllite slates of Chatham and Moore Counties, occurs near Warm Springs, Madison County. The most interesting occurrence of muscovite is that resulting from the alteration of corundum. In this connection it is found in many varieties. It is sometimes in compact masses, with a crystalline structure and a yellowish white color, surrounding the corundum as at the Haskett mine, Macon County, or it envelops the nodules of corundum, as at Belt's Bridge, Iredell County, and has a very fine fibrous structure with delicate silky luster, the fine particles gradually assuming a scaly structure and large size. At Crowder's and Clubb's mountains and Oulsagee mine, Macon County, the muscovite, surrounding corundum, occurs in the form of small silver white scales, usually discolored by a thin coating of oxide of iron. At the Hogback mine, in Jackson, and especially in Haywood County, it occurs in a similar manner, but it frequently surrounds large masses of corundum with a compact or semi-fibrous coating with silky luster, which towards the margin becomes more crystalline and scaly; at the Presley mine, Haywood County, it is found in very fine scales, gradually increasing to plates of an inch in diameter, and sometimes directly into large hexagonal crystals of 3 to 4 inches in diameter, still inclosing nuclei of the original mineral.

The following have been analyzed in the laboratory of the University of Pennsylvania, I to IV:

- I. The finely fibrous from Belt's Bridge, by Miss Mary T. Lewis.
- II. The fine scales from Crowder's Mountain, by Thos. M. Chatard.
- III. The fine scales from Oulsagee, by Geo. A. Koenig.
- IV. Plates of about 1 inch in diameter from the Presley mine, by myself.

V. Carefully purified crystals from the Emerald and Hiddenite mine, analyzed by F. W. Clarke in the laboratory of the U. S. Geological Survey.

The following are the results :

	I.	II.	III.	IV.	V.
Sp. gr.....		2.860	2.867		
Silica	45.96	43.51	45.62	44.89	45.40
Titanic oxide					1.10
Alumina	38.22	37.85	35.93	38.02	33.66
Ferric oxide	0.61		2.93	1.96	2.36
Magnesia		0.31	0.34	0.14	1.86
Lime	0.37	0.42	trace.	0.30	
Lithia		trace.	trace.		trace.
Soda	0.74	1.04	0.71	0.69	1.41
Potash	9.21	11.35	9.40	10.26	8.33
Fluorine					0.69
Ignition	4.89	7.73	4.93	4.50	5.46
	100.00	102.21	99.86	100.67	100.27
Less oxygen					0.29
					99.98

The soft, pseudomorphous crystals in the form of staurolite from Cherokee County are probably muscovite.

LABRADORITE.

A white, and in some portions colorless, very lustrous, cleavable variety with very few triclinic striæ, occurs at the Cullakenee mine, in Clay County. It has a sp. gr. of 2.62. I had it analyzed in the laboratory of the University of Pennsylvania by Mr. W. H. Jarden, who found :

Silica	55.61
Alumina	26.90
Lime	9.60
Soda	6.97
Potash	0.55
Ignition (water)	0.35

99.98

It has been found in gray, granular, cleavable masses, but only at a few localities.

Near the road, 6 miles north of Burnsville, in Yancey County, it is associated with mica, garnet, etc., as one of the constituents of a stratified rock ; it occurs in a trap near the Tuckasegee Ford, half a mile from the Catawba River, on the road to Charlotte, in Mecklenburg County ; also at Shiloh Church in Granville County, and in large crystals in the heavy trap on Toe River below Bakersville, Mitchell County. The latter locality furnishes specimens which show slightly the play of bluish colors. It is one of the constituents of the cryptocrystalline trap-rock found throughout the State.

ANDESITE.

In snow white and bluish white, cleavable masses, showing fine striae upon the cleavage planes, associated with black hornblende or arfvedsonite at the Cullakenee mine, Clay County; and from the same locality as a very fine-grained, white feldspar associated with zoisite and margarite, and like the latter, resulting from the alteration of corundum. Both have been analyzed—the first by G. A. Koenig (I), the latter by T. M. Chatard (II):

	I.	II.
Sp. gr.	2.611	2.610
Silica	57.29	58.41
Alumina	28.52	25.93
Ferric oxide	0.21	0.38
Magnesia	0.15	0.18
Lime	7.80	5.82
Soda	6.75	6.45
Potash	0.33	2.10
Loss by ignition	1.43	0.93
	100.48	110.20

There are similar white feldspars at the Hogback mine in Jackson County, and at the Culsagee mine in Macon County, which may belong here. No others have been analyzed.

OLIGOCLEASE.

A fine-grained, grayish white feldspar, through which minute particles of black tourmaline are disseminated, occurs in considerable quantities at Culsagee, Macon County, and at the Carter mine, in Madison County. In 1887, at the Hawk mica mine near Bakersville, a peculiar transparent oligoclase was discovered. It was of a faint greenish tint, and clear enough to cut small gems; in fact, it resembled glass more than it did feldspar, especially as it contained stellate tufts of microliths. Analyses as follows:

- I. From Culsagee, by J. L. Smith.
- II. From Culsagee, by Harry M. Keller.
- III. From Bakersville, by F. W. Clarke.
- IV. From Bakersville, by E. S. Sperry.

	I.	II.	III.	IV.
Silica	64.12	62.32	62.92	62.60
Alumina	24.20	25.19	25.32	23.52
Ferric oxide	0.14		trace	0.08
Manganese oxide			trace	
Lime	2.80	5.01	4.03	4.47
Soda	9.28	8.02	6.18	8.62
Potash		0.25	0.96	0.56
Ignition			0.25	0.10
	100.54	101.79	99.66	99.95

Sp. gr. of the Bakersville mineral, 2.651.

A beautiful variety of "sunstone" oligoclase has been found by Mr. J. A. D. Stephenson near Statesville, Iredell County, associated with yellowish white titanite.

ALBITE.

It is found in large, cleavable masses of a white color, at Point Pizle, Mitchell County, showing upon the cleavage planes more or less distinct striation. I had it analyzed in the laboratory of the University of Pennsylvania by Frank Julian (I), (see below). Sp. gr. 2.638. There are probably many of the white and grayish or brownish white striated feldspars from mica mines, such as from the Gibbs mine, South Toe River, Yancey County; the Flat Rock mine and the Buchanan mine, in Mitchell County; Ainslie's, in Jackson County; and Thorn Mountain mine, in Macon; and many others, which belong to this species or to oligoclase, which can be distinguished only by analysis. An interesting occurrence is that at the Presley mine, Haywood County, where it, together with muscovite, results from the alteration of corundum. Small white granular cleavable albite, and also compact masses, have been found at the Steele mine, Montgomery County, associated with prochlorite, gold, pyrite, sphalerite, etc. Finely crystallized at the Emerald mine, in Alexander County.

Some of the granitic rocks 3 miles west of Leasburg, Caswell County, contain small grains of a triclinic feldspar, which may be albite.

The compact grayish white variety from the Steele mine has been analyzed by Geo. J. Popplein (II):

	I.	II.
Silica	67.51	60.29
Alumina.....	20.46	19.66
Ferric oxide.....	trace	4.63
Manganese oxide.....		trace
Magnesia.....	0.34	0.23
Lime.....	3.08	1.83
Soda.....	9.15	9.90
Potash.....	trace	1.71
Loss by ignition.....		1.20
	100.54	99.45

ORTHOCLASE.

This is one of the most widely distributed minerals in the State, forming an essential constituent of all the granite, gneiss, etc. It is found in beautiful crystals in a band of porphyritic granite, near Salisbury, Rowan County; the High Shoals and White's mill, in Gaston County; and on Hitchcock's Creek, and elsewhere in Richmond County; also in the "chesterlite" form at Silver Hill, associated with *pyromorphite* and quartz. Cleavable masses of orthoclase are found

at Houp's farm, near Statesville, and near *Belt's Bridge*, *Iredell* County. A peculiar variety with satiny luster upon the cleavage planes occurs in Clay County, near Cullakenee. Large lamellar masses of a white, grayish or reddish color occur at Ray's mine, Yancey County; at Flat Rock, Blalock's, and near Bakersville, in Mitchell County; also in Caldwell County; at Hampton's Mining Creek, near Burnsville, Yancey County; on Sugartown Turnpike, 10 miles from Franklin; at the Whiteside Mountain, in Macon County; on French Broad River, in Madison County; and in the mica mines everywhere. The Burnet mica mine, Buncombe County, furnished the museum with a crystal weighing 800 pounds. The peculiar compact variety of orthoclase which is spotted with hydrated sesquioxide of manganese, the so-called "leopardite," is found near Charlotte, Mecklenburg County, and also in Gaston County. It is a variety of porphyry with crystals of quartz disseminated in it. I have made an analysis of the feldspathic constituent, which has a yellowish white color and a cryptocrystalline structure (I). Miss Mary T. Lewis has analyzed in the laboratory of the University of Pennsylvania the orthoclase from Houp's farm, Iredell County (II).

	I.	II.
Silica	75.92	64.56
Alumina	14.47	20.60
Ferric oxide	0.88	
Magnesia	0.09	.....
Lime	0.02	0.36
Soda	4.98	trace.
Potash	4.01	14.85
	100.01	100.37

TOURMALINE.

The tourmalines, found in many localities in North Carolina, are mostly of the black variety. A small, well terminated, transparent green crystal was found by Col. Mills on Silver Creek, Burke County; also a black crystal 4 inches long, embedded in a green beryl crystal. Crystals of from 1 to 2 inches in size have been found near Mountain mine, Cleveland County; on Upper Little River, Caldwell County; at Hanging Dog Creek, in Cherokee; and in Rutherford, Mecklenburg, Yancey, Mitchell, Macon, Haywood, Transylvania, Polk, Buncombe, Caldwell, Stokes, Johnston, Wake, Granville, and other counties. In beautiful, well terminated crystals of 2 to 3 inches in length it is found in the South Mountains 16 miles southeast of Morganton, in Burke County; also near King's mill, Iredell County; and at Warren's, near Salem Church; and at John Lackey's and Isaac Price's, on the White Plains, Alexander County. In slender black crystals, often radiating and needle-shaped, frequently flattened between the plates of muscovite, it is

found at Ray's mine, near Burnsville, where also a greenish and yellowish green, fibrous, and finely columnar variety occurs. It is frequently and in large masses associated with the corundum of Culsagee mine, in Macon County. At the Cullakenee mine, Clay County, it is found in small quantity; also at the Hogback mine, Jackson County, and with the corundum and muscovite at Belt's Bridge, in Iredell County. A large outcrop of fibrous and granular tourmaline, with quartz, is found about two hundred yards northeast of the Ellison mine, on the High Shoals property, in Gaston County, and a peculiar finely striated variety, with quartz, at Clubb's Mountain; similar finely fibrous, wood-like masses occur at Leasburg, Caswell County, and in Wake. It has also been observed in the gold bands from Burke County. Tourmaline rock and slate have been noticed at Kernersville, Guilford County; at Bee Rock, head of Turkey Creek, in McDowell County; at Jeanstown, Rutherford County, 6 miles south of Asheville, on the Hendersonville road, and in Cleveland County.

At the Emerald and Hiddenite mine, in Alexander County, Mr. W. E. Hidden found some brilliant black crystals of tourmaline with fine, polished terminations. An analysis of this tourmaline, made by K. B. Riggs in the laboratory of the U. S. Geological Survey, gave results as follows:

Silica.....	35.56
Alumina.....	33.38
Ferrous oxide.....	8.49
Titanic oxide.....	0.55
Manganous oxide.....	0.04
Lime.....	0.53
Magnesia.....	5.44
Soda.....	2.16
Potash.....	0.24
Water.....	3.63
Boric oxide.....	10.40
	100.42
Sp. gr., 3.13.	

FIBROLITE.

A reddish white, finely fibrous mineral, with silky luster, from Macon County, probably belongs to this species.

A very interesting occurrence of fibrolite has lately been discovered near Shoup's ford, in Burke County, where it is the result of the alteration of corundum and envelops a core of the original mineral. The fibrolite may, in part, have been changed into muscovite, as it occurs in the micaschist of the neighborhood in small, needle-shaped crystals. A mineral resembling fibrolite is found in quartz in the gold gravel of Burke and McDowell Counties.

CYANITE.

This is one of the characteristic accessories in many of the mica and hornblende schists of Macon, Haywood, Transylvania, Yancey, Mitchell,

Caldwell, Catawba, Gaston, and other counties, and is generally of a grayish white or gray color, and in imperfect crystals. Fine crystals occur at Clubb's and Crowder's Mountains, Gaston County; coarsely bladed masses of a blue and greenish color at Swannanoa Gap, Buncombe County; also near Ray's mica mine, on Hurricane Mountain, and elsewhere in Yancey County; Mitchell, Cherokee, and Wilkes counties; six miles east of Danbury, in Stokes County; and near Davidson College, Mecklenburg County. In blue and white bladed crystals in quartz at Hoover's farm, 6 miles southwest of Statesville; also in gravel near Statesville, Iredell County. A grayish white, radiating cyanite is found at Ararat River, 4 miles southeast of Mount Airy, in Surry County, and a white cyanite at the foot of Barnett's Mountain, in Person County. Cyanite also occurs on Valley River, in Cherokee; at Tipton's, in Clay County; in quartz at the head of Jonathan's Creek, in Haywood County; on Bear Creek, in Madison County; at the Buchanan mine, Mitchell County; in the northwest corner of Wake County, and in Moore and elsewhere. At Hunting Creek, north of Statesville, rheticite in columnar and radiating masses is found, resulting from the alteration of corundum. On Yellow Mountain, near Bakersville, cyanite occurs in very deep blue crystals, equal in color to the finest sapphire. Fine gems have been cut from this mineral.

The white cyanite associated with the lazulite of Clubb's Mountain has been analyzed by Smith and Brush (I); and a brownish white variety from the gravel near Statesville (II) was analyzed by myself:

	I.	II.
Ignition		0.38
Silica	37.60	36.85
Alumina	60.40	63.15
Ferric oxide	1.60	trace.
	99.60	100.38

At many localities, notably in Cherokee County, cyanite occurs largely altered into a fine, scaly muscovite.

TOPAZ.

Topaz is reported as occurring at Crowder's Mountain, but it is very doubtful; crystals from there, which were considered topaz, are cyanite. The variety pycnite occurs in finely columnar aggregations of a yellowish and brownish yellow color, associated with garnets, near White's mill, Gaston County.

EUCLASE.

Gen. Clingman mentions a very handsome crystal of this rare mineral from the gold mine of the late Morril Mills, in the eastern part of Polk County.

TITANITE.

Gen. Clingman mentions titanite, or sphene, as occurring in Buncombe County. I have observed it at Morganton Springs, Burke County, in minute brown crystals; in hornblende slate and in granite at White's mills, in Gaston County; at Rogers's ore bank, near Danbury, in Stokes County; and on Hurricane Mountain, Yancey County. To this species probably belongs Prof. Shepard's very doubtful species, pyromelane, from the gold washings of McDowell County. Hidden reports titanite also in Alexander County.

Shepard's xanthitane (q. v.) is an alteration of titanite from Green River, in Henderson County. It often contains unaltered titanite as a nucleus.

I have analyzed a yellowish white titanite which occurs near Statesville, Iredell County, in mica schist, associated with sunstone oligoclase. The crystal was 15mm. broad and 2mm. thick. Sp. gr., 3.477. It contained—

Silica	29.45
Titanic oxide.....	38.33
Ferric oxide.....	1.61
Manganous oxide.....	trace
Magnesia	trace
Lime	29.11
Loss by ignition.....	0.60
	99.10

STAUROLITE.

Very large, brownish red crystals, from $2\frac{1}{2}$ to 3 inches in length and 1 to $1\frac{1}{2}$ inches wide, single individuals as well as twins, occur at the Parker mine, in Cherokee County. There are many other localities in Cherokee and Macon Counties where it occurs abundantly in argillaceous and talcose slates, as on Persimmon Creek and Hanging Dog Creek; on Bear Creek, Madison County, and Tusquittah Creek, in Clay County. It is found in very small quantity with corundum and chlorite in small, reddish brown grains of vitreous luster, but without distinct form, at the Culsagee mine, Macon County. They have a sp. gr. of 3.711. An analysis which I have made gave—

Silica	27.91
Alumina	52.92
Ferric oxide.....	6.87
Ferrous oxide.....	7.80
Magnesia	3.28
Lime and manganous oxide.....	traces
Ignition (water)	1.59
	100.37

HYDROUS SILICATES.

CHRYSOCOLLA.

Inferior specimens, generally much mixed with other copper ores, have been observed at many of the copper mines; for instance, at the

Gardner Hill and Cambridge mines in Guilford County, the Pioneer Mills in Cabarrus County, the Gillis mine and at Mill Creek in Person County, Northington's dam in Harnett County, Wolf Creek mine in Jackson County, at Welch's in Moore County, at Grupy mine and elsewhere in Rowan County, near Elkin in Surry County, the Hopewell in Mecklenburg County, at the Olegg mine and at Snipes' iron mine in Chatham County, Gap Creek mine in Ashe County, and many other places.

CALAMINE.

The only specimen of calamine which I have observed came from Silver Hill, Davidson County, where it occurs sparingly as an incrustation of fibrous and radiating structure upon argentiferous galenite.

TALC.

Resulting from the alteration of chrysolite, foliated talc of a white or greenish white color is found in many of the chrysolite beds west of the Blue Ridge; at Shooting Creek, Clay County; Culsagee, Macon County; Webster, Jackson County; Hampton's, Mining Creek, and Young's, on South Toe River, Yancey County; near Bakersville, Mitchell County, and other localities; in sheets of three-quarters to one inch in thickness and of a somewhat columnar structure near Pilot Mountain, and near Dobson, Surry County; fibrous talc with silky luster and of a white or green color, also compact crystalline white talc with a splintery structure, on Valley River, Cherokee County, and in Macon County. Talcose slate and coarse soapstone are found in many localities throughout the State; it has been noted in some thirty counties: for instance, near Belt's Bridge, Iredell County; in the South Mountains of Burke County; in Caldwell; in Haywood County; near Waynesville; in the north of Wake County, etc. I have analyzed a specimen from Webster, Jackson County (I), and Mr. J. B. Adger has analyzed a compact, faintly greenish variety found 8 miles from the mouth of the Nantahala River (II), as follows:

	I.	II.
Sp. gr. ....	.....	2.82
Water	.34	6.01
Silica	64.44	57.72
Alumina	.48	2.52
Ferrous oxide	1.39	.64
Nickel oxide	.23	.....
Magnesia	33.19	33.76
	100.07	100.65

PYROPHYLLITE.

In white, yellowish, greenish, and brownish white, stellate aggregations, and in fibrous and radiated masses at Cotton Stone Mountain, Montgomery County; also at Pilot Knob, Randolph County; Davidson College, Mecklenburg County; Hillsboro, Orange County; on Bowlings Mountain, in southern Granville County, in great abundance; Crowder's and Clubb's Mountains, in Gaston County; and on Linville Mountain, McDowell County. The slaty variety forms large beds of yellowish white or greenish color in Chatham, Moore, and Orange Counties.

A schistose imperfectly lamellar variety from the Deep River has been analyzed by Samuel T. Tyson (I), and a similar one, of a somewhat whiter color, from Carbondon, by O. D. Allen (II):

	I.	II.
Sp. gr.....	2.92	2.88
Silica.....	65.93	66.25
Alumina.....	29.54	27.91
Ferrous oxide.....	5.40	1.08
Water.....	5.40	5.25
	100.87	100.49

STILPNOMELANE (?).

A mineral, similar to stilpnomelane, has been found in compact greenish black masses at the Cosby mine, Cabarrus County.

GLAUCONITE.

The green grains forming one of the constituents of many of the so-called marl beds in the eastern part of the State are glauconite. It occurs in most of the counties of that section south of Tar River.

SERPENTINE.

The massive varieties are found in many localities. The best appears to come from the neighborhood of Patterson, Caldwell County. It has a dark, greenish black color, contains fine veins of the yellowish green, fibrous and silky chrysotile, and admits of a fine polish; greenish gray, massive serpentine, also with seams of greenish and grayish white chrysotile, is found at the Baker mine in Caldwell County, at which place are also found the varieties marmolite and picrolite; this last also occurs abundantly in the Buck Creek corundum mine, Clay County. Dark green serpentine has been observed in the neighborhood of Asheville in Buncombe County, and in Forsythe and Wake Counties. A grayish or yellowish green serpentine occurs in Caldwell, Wilkes, Surry, Yancey, Stokes, Orange, and Wake Counties, and in the chrysotile beds of Macon, Jackson, Yancey, Mitchell, Watauga, Burke, and other

counties; it results from the decomposition of the chrysolite, which, however, is not always complete and gives rise to intermediate stages, in which we have to deal with mixtures of both species. Such a mixture from the Cullakenee mine, Clay County, has been analyzed by me (I), also a compact massive serpentine resembling the variety williamsite, from the chrysolite beds of Webster (II).

The picrolite from Buck Creek has been recently analyzed by Dr. E. A. Schneider, of the Geological Survey (III), who has also analyzed an alleged deweylite from Corundum Hill (IV), which proves to be only serpentine:

	I.	II.	III.	IV.
Silica	35.19	43.87	42.94	41.99
Alumina	0.64	0.31	1.72	0.71
Ferric oxide			3.33	0.91
Ferrous oxide	9.70	7.17	1.88	undet.
Nickel oxide		0.27	0.61	0.10
Manganese oxide		trace		
Magnesia	40.99	38.62	36.53	40.16
Lime		0.02		
Water	13.48	9.53	13.21	16.16
Chromite		0.57		
	100.00	100.38	100.22	99.94

DEWEYLITE.

This mineral is found in all the chrysolite beds of the western counties, in yellowish and greenish masses, in thin veins or seams through the decomposed rocks.

For the supposed deweylite of Corundum Hill see serpentine.

CEROLITE.

In small veins or seams in decomposed chrysolite at Culsagee mine, Macon County, forming white or yellowish masses. It has not been analyzed.

GENTHITE.

In amorphous apple-green coatings upon decomposing chrysolite, at Webster, Jackson County, sparingly at the Culsagee mine, Macon County, and also on Ivy River, Buncombe County.

KAOLINITE.

Snow-white kaolin is found as the result of the decomposition of orthoclase at most of the mica mines in Mitchell, Yancey, Macon, Ashe, and other counties. Good qualities are found 6 or 7 miles from Newton, Catawba County; also in Lincoln, Burke, and many other counties. Clay for firebricks and earthenware occurs in many localities throughout the State.

SAPONITE.

Found in Mitchell County, near Bakersville, in the cavities of the cellular hornstone of the chrysolite; popularly known as mountain talow. Has not been analyzed.

HALLOYSITE.

Found near Salem, Forsyth County; is of an olive green color and waxy luster. The variety lithomarge occurs in Burke County.

A white, compact halloysite from Chatham County, analyzed by myself, gave:

Water	17.78
Silica	44.40
Alumina	36.88
Ferric oxide.....	0.95
	100.01

PINITE.

This mineral is found as a light gray to pale or dull greenish coating in the joints and seams and between the laminae of the conglomeritic and felsitic slates of the Huronian series in the middle counties, and also in the granulites of the Blue Ridge. Has not been analyzed.

PARAGONITE.¹

Is found in the so-called talcoid and talco-micaceous schists of the Piedmont section, especially in Burke, Caldwell, and Catawba; it is a common constituent of the soft brown and purple schists so common as to be characteristic of the region. It is also to be seen at Round Knob, in McDowell, in the altered schists and slates exposed in the railroad cuts, in similar rocks in Wake County, near Raleigh, and in many other localities. Has not been analyzed.

HISINGERITE (?).

The chloritic dust which coats the mica and dolomite of the Emerald and Hiddenite mine, in Alexander County, probably belongs to this species. Partial analysis by F. W. Clarke:

Ignition	20.50
Silica	31.16
Alumina.....	8.06
Ferric oxide	35.86
Magnesia	5.43
	101.01

The iron is undoubtedly present chiefly, but not wholly, as *ferrous* oxide; and the alumina is due to admixed mica. Very little material was available for the analysis.

¹ The species saponite, pinite, and paragonite are inserted upon the authority of the late Prof. W. C. Kerr. They need further investigation.

CULSAGEEITE.

The mineral which I had described as jefferisite from Culsagee, has been distinguished by Prof. Josiah P. Cooke, jr., as *culsageeite*. It occurs in broad laminæ or plated masses of a yellowish brown color, sometimes 4 or 5 inches in diameter, which when heated exfoliate in a remarkable manner. It is also found at the same locality in greenish, or brownish, yellow scales, not over one-eighth of an inch in diameter. Both varieties have been analyzed, the former by Geo. A. Koenig (I), the latter by Thos. M. Chatard (II). J. P. Cooke, jr., has also analyzed the large plates, but his analyses represent the mineral after having been dried at 100° C. (212° F.) by which operation it lost from 10.19 to 10.27 per cent of water.

	I.	II.	III (dried).
Sp. gr.			2.225
Silica	33.93	34.00	37.58
Alumina	17.38	20.36	19.73
Ferric oxide	5.42	4.91	5.95
Ferrous oxide	0.50	0.42	0.58
Nickelous oxide	0.35	0.57	
Magnesia	23.48	21.71	25.13
Water	19.17	18.50	11.09
	100.18	100.47	100.06

It likewise occurs on Ivy River near Carter's, Buncombe County, at Carter's mine, Madison County, and in Henderson County, at Coleman's Station.

KERRITE.

Consists of innumerable fine scales of pale greenish yellow color and pearly luster. Exfoliates when heated, but less so than culsageeite. From the Culsagee mine.

Analyses (I) by T. M. Chatard, mean of two; and (II) by E. A. Schneider :

	I.	II.
Sp. gr.	2.303	
Silica	38.29	38.13
Alumina	11.41	11.22
Ferric oxide	1.95	2.28
Ferrous oxide	0.32	0.18
Nickel oxide	0.25	0.48
Cobalt oxide		trace
Magnesia	26.40	27.39
Water	21.25	20.47
	99.87	100.15

MACONITE.

Closely resembles fine, scaly culsageeite. Dark brown, with pearly luster, inclining to submetallic. Largely exfoliating, when heated. Numerous fragments of bluish gray corundum are embedded in it.

The carefully selected pure scales were analyzed by Thos. M. Chatard who found as the mean result of two analyses:

Silica.....	34.22
Alumina.....	21.53
Ferrie oxide.....	12.41
Ferrous oxide.....	0.32
Nickel oxide.....	0.12
Magnesia.....	14.46
Lithia.....	trace
Soda.....	0.51
Potash.....	5.70
Water.....	11.85
	101.12

Sp. gr., 2.827.

LUCASITE.

Similar to culsageeite in appearance, yellowish brown in color, made up of small foliæ, not over 2mm. in diameter; also compact disseminated; basal cleavage eminent; luster submetallic, somewhat greasy; exfoliates much on ignition; found associated with grass-green actinolite at Corundum Hill, Macon County; described by Dr. T. Chatard, whose analysis is as follows:

Water, expelled at 110° C.....	3.78
Water, at red heat.....	6.98
Silica.....	31.81
Alumina.....	12.99
Chromic oxide.....	0.54
Ferrie oxide.....	5.29
Ferrous oxide.....	0.11
Manganous oxide.....	0.05
Magnesia.....	24.83
Lime.....	0.14
Soda.....	0.20
Potash.....	5.76
	100.48

PENNINITE.

The variety *kämmererite*, in violet and peach-blossom red shades, is associated with chromite at Culsagee in Macon County, Webster's Mountain, Jackson County; Hampton's, Mining Creek, Yancey County; 1 Mountain, Watauga County, etc.; three-sided and six-sided platy crystals of a dark greenish and purplish color, associated with corundum, etc., in the chrysolite beds at the same localities; also at Bakersville, Mitchell County, and Scott's Creek, Jackson County.

PROCHLORITE (AND CHLORITE).

fine-grained, scaly prochlorite, of a dark green color, rarely in worm-aggregations, is found associated with an albitic rock, from an action of which it has resulted, at the Steele mine, Montgomery city. At the Culsagee mine, prochlorite occurs as the result of the action of corundum, often showing the form and containing yet a part of the original mineral. Frequently the corundum has first changed into spinel and the latter has subsequently been altered into chlorite, but in either case, where it touches the original mineral, frequently of a fine, scaly, pseudo-fibrous structure and becoming laminated at a greater distance. But this is not always the case, very often broadly foliated prochlorite is in immediate contact with corundum. Both the laminated and fine scaly form beds of considerable size. Under similar circumstances it is found at the Hogback in Jackson County, at Shooting Creek in Clay County, near Marshall, at the Carter mine in Madison County, and at many other corundum-mines.

The so-called corundophilite of Shepard, which was established by the name of the prochlorite of Marshall, has no existence in North Carolina.

Chlorite in scales and scaly aggregations is found in many of our gold and copper mines in the State, and chloritic slate at many localities throughout the whole slate belt, and in many counties outside of it, both in the Huronian and Montalban rocks.

We have analyzed the broadly foliated dark green variety (I), and the scaly variety diverging from corundum (II), both from Culsagee; the fine scaly prochlorite from the Steele mine (III):

	I.	II.	III.
Silica	27.56	29.48	24.90
Alumina.....	22.75	22.22	21.77
Ferric oxide	2.56	0.70	4.60
Ferrous oxide	5.43	5.30	24.21
Nickelous oxide	0.30	0.11	.....
Manganous oxide.....		0.17	1.15
Magnesia	28.47	30.09	12.78
Water	13.80	11.63	10.50
	100.87	100.60	100.00

Analyses of other specimens from Culsagee, made by Thos. M. Chas. and J. L. Smith, gave similar results. It will be seen from these analyses that they are varieties in which a large portion of the ferrous oxide is replaced by magnesia.

The massive chloritic mineral in aggregations of minute scales, much resembling thuringite, has been found at Mount Pisgah, Iredell County. We have made an analysis of it, but as it was too much oxidized, the amount of ferrous oxide could not be ascertained with accuracy, and

therefore a doubt exists as to the species to which it belongs. The analysis gave:

Silica	24.22
Alumina	19.34
Ferric oxide	17.77
Ferrous oxide	20.98
Manganous oxide	0.07
Magnesia	5.72
Water	12.22
	100.32

Several other chloritic minerals from Corundum Hill have been analyzed by Dr. T. M. Chatard in the laboratory of the U. S. Geological Survey, but microscopic examination would be necessary to establish identity of species.

CHLORITOID.

In small scales of a greenish black color, disseminated through slaty pyrophyllite, from Evans's mill, in Chatham County. I have made an analysis of the carefully purified scales:

Silica	26.13
Alumina	40.11
Ferric oxide	3.44
Ferrous oxide	23.01
Manganous oxide	trace
Magnesia	0.94
Water	6.91
	100.54

Sp. gr., 3.353.

WILLCOXITE.

Greenish and grayish white fine scales of a pearly luster, much resembling talc, occur occasionally as the result of the alteration of corundum. One specimen from Shooting Creek, Clay County, is a fragment of a semi-globular mass with a core of white corundum; it also occurs in small quantity at Cullakenee, Clay County, and probably at Culsagee, Macon County.

Both, that from Shooting Creek (I) and that from Cullakenee (II), have been analyzed by George A. Koenig:

	I.	II.
Silica	28.96	29.50
Alumina	37.49	37.56
Ferric oxide	1.26	1.40
Ferrous oxide	2.44	2.38
Magnesia	17.35	17.20
Lithia	trace	trace
Soda	6.73	6.24
Potash	2.46	2.42
Water	4.00	3.82
	100.69	100.03

MARGARITE.

In small foliated masses of silver-white color and pearly luster, some of the folia showing planes of crystals associated with the corundum at the Culsagee mine (I); it has also been found with the mass of blue corundum found at Marshall, Madison County; but the most beautiful varieties are found at Cullakenee, Clay County, where it occurs in groups of laminated crystals, sometimes 2 inches long, $1\frac{1}{2}$ wide, and five-eighths inches thick, of a slightly pinkish white color and pearly luster (II). These groups contain sometimes a nucleus of corundum, from which they are derived. The second variety from the same locality occurs in the form of broad laminae of a pinkish color, intermixed with corundum and associated with zoisite (III); a third variety from Cullakenee is found in thin seams of a grayish green color, which are an aggregate of minute pearly scales of a greenish white and sea green color (IV). It is found rarely in Hogback mine, Jackson County. The gray corundum from Penland's, Olay County, is surrounded by a white and yellowish-white cryptocrystalline and pseudofibrous margarite, and a similar incrustation is found upon the blue corundum at Crowder's Mountain.

A peculiar variety of soda margarite, of a compact and cryptocrystalline structure, surrounds the hexagonal corundum crystals from Hendrix's farm, near Belt's Bridge, Iredell County. It has been analyzed in the laboratory of the University of Pennsylvania by Frank Julian (V). I have analyzed the margarite from Culsagee (I); Thos. M. Chatard the first variety (II), and I the second (III) and third (IV) varieties from Cullakenee:

	I.	II	III.	IV.	V.
Sp. gr.	3.087	2.990	3.055	3.064	.....
Silica	28.11	29.34	30.72	29.63	33.10
Alumina	49.16	48.73	49.83	51.19	52.20
Chromic oxide .....	.....	.....	.....	0.13	.....
Ferrous oxide	0.43	0.78	0.84	0.59	trace
Magnesia	0.45	0.78	0.76	1.09	.....
Lime	11.08	11.32	10.84	11.28	8.44
Lithia	0.45	trace	trace	.....	.....
Soda	0.67	2.61	2.19	1.22	2.59
Potash	0.22	0.10	0.26	0.20	.....
Water	6.43	6.55	6.21	4.73	4.85
Corundum	3.31	.....	.....	.....	.....
	100.31	100.21	101.65	100.06	101.18

DUDLEYITE.

Found in small quantity in soft, bronze colored or brownish yellow scales with pearly luster, slightly exfoliating when heated. They are probably the result of the alteration of margarite, and are found with it rarely at the Cullakenee mine, Clay County.

URANOTIL.

About one-third of the so-called "gummite" is an admixture of uranotil, but this mineral is also obtained in a nearly pure state by the further decomposition of the uraninite or rather gummite. It is then found in apparently amorphous, compact masses, without or with a waxy luster, and a pale straw or lemon yellow color; opaque and of uneven fracture; sp. gr. 3.834; incrusting the gummite, but sometimes the whole mass of the nodules changed into uranotil.

The mean result of two analyses which I made is:

Silica	13.72
Uranic oxide.....	66.67
Plumbic oxide	0.60
Baryta	0.28
Strontia	0.13
Lime	6.67
Phosphoric acid.....	0.29
Water	12.02
	100.38

From the Flat Rock mine, Mitchell County. Found also with gummite at the Deake, Lewis & McHone mines.

The late Prof. W. C. Kerr also reported "uranochre" as a yellow to orange incrustation from Gibbs's mine, Yancey County, and the Flat Rock and Buchanan mines in Mitchell County. "Zippeite" is given by him on the authority of Julien as occurring at the Higdon mine, Macon County. Both species are extremely doubtful, and may be only varieties of uranite and phosphoranylite.

THORITE.

Identified by Penfield both microscopically and chemically as a mechanical admixture in the monazite sands of Brindletown, Burke County.

AUERLITE.

A new species discovered by Hidden and Mackintosh at the Zircon mine, in Henderson County, and also at Price's farm, 3 miles southwest of the first-named locality. Color, pale yellow to orange and brownish red. Hardness, 2.5 to 3; sp. gr. 4.4 to 4.766. Very brittle and easily crumbled. Form like zircon, and the crystals, simple in habit, are often attached to zircon in parallel position. Twins, like those of zircon, have been observed.

Analyses by Mackintosh :

	I.	II.	III.
Water	9.88	} 11.21	
Carbonic acid	1.00		
Silica		7.04	8.25
Phosphoric acid		7.46	7.59
Thorium oxide		70.13	
Ferric oxide		1.38	
Lime		0.49	
Magnesia		0.29	
Alumina, etc.		1.10	
		99.70	

The lemon yellow variety found on the Price land has a sp. gr. of 4.03 to 4.08, and is richer in phosphoric acid and poorer in silica than the foregoing mineral. The data are water, 10.64; phosphoric acid, 8.58; silica, 6.84. The thoria determination was lost.

XANTHITANE.

Although not a silicate this mineral may best be placed here. It occurs abundantly in the Zircon mine at Green River, Henderson County, and is a yellow, earthy pseudomorph after titanite. The crystalline form is often well shown, and the xanthitane frequently contains an unaltered core of titanite, from which mineral it has been derived. Analysis by L. G. Eakins:

Water lost at 100° C	6.02
Water lost at red heat	9.92
Silica	1.64
Titanic oxide	57.46
Alumina	16.41
Ferric oxide	4.16
Lime	0.84
Magnesia	trace
Phosphoric acid	3.89
	100.34

Sp. gr., 2.941 at 24° C.

The mineral is evidently an aluminous clay, containing titanium in place of silicon.

TANTALATES, COLUMBATES.

PYROCHLORE OR MICROLITE.

Microscopic brownish yellow or honey yellow grains, and crystals which appear to be octahedra with dodecahedral planes, are associated with orthoclase, tourmaline, etc., at Ray's mica mine, on Hurricane Mountain, Yancey County, and are probably pyrochlore or perhaps microlite. Larger octahedra are reported to have been found at the Flat Rock mine in Mitchell County, and were called microlite. I have never seen any; those sent to me as microlite were garnet.

HATCHETTOLITE.

In octahedral crystals with cubical planes, of a yellowish brown color, with grayish opalescence, resinous luster, and subconchoidal fracture. Hardness, 5; sp. gr., 4.851.

Three analyses of it have been made by J. L. Smith, the mean results of which I give (I), and one by O. D. Allen (II):

	I.	II.
Tantallic oxide	67.04	29.83
Columbic oxide		34.24
Titanic oxide		1.61
Tungstic oxide	0.75	0.30
Stannic oxide		
Plumbic oxide		trace
Uranic oxide	15.61	15.50
Ferrous oxide	2.24	2.19
Cerous oxide	1.17	
Yttria		
Magnesia		0.15
Lime	7.31	8.87
Soda		1.37
Potash	0.86	trace
Loss by ignition	4.87	4.49
	99.85	98.55

Found with samarskite at Wiseman's mine, Mitchell County.

TANTALITE.

A massive variety of tantalite, weighing a few ounces, has been collected by the late Prof. F. H. Bradley, in Yancey County. It had a black color and a specific gravity of 6.88; and has been analyzed by W. J. Comstock, who found:

Tantallic oxide	59.92
Columbic oxide	23.63
Ferrous oxide	12.86
Manganous oxide	3.06
Magnesia	0.34
	99.81

COLUMBITE.

It occurs in crystals and crystalline masses of a black color embedded in the samarskite of Wiseman's mine, Mitchell County. It has also been found at the Deake mine and other localities in the same county, at Ray's mine in Yancey County, near Burnsville; at Balsam Gap mine in Buncombe, and near Franklin, in Macon County. One crystal of it was kindly sent me by Mr. J. A. D. Stephenson, of Statesville, which he had found at Isaac Price's farm, White Plains, Alexander County. I have a crystal of about 2 inches in length, $1\frac{1}{2}$ in width and

$\frac{1}{2}$ in thickness, from Capt. Mills's mine, Burke County, which appears to belong to this species.

J. L. Smith has analyzed the crystals (I) and massive varieties (II) from Wiseman's mine, and I that from Isaac Price's farm (III):

	I.	II.	III.
Sp. gr.	5.562	5.485	5.758
Columbic and tantallic oxides	80.06	80.82	79.90
Tungstic and stannic oxides	1.21	1.02	0.56
Ferrous oxide	14.14	8.73	15.14
Manganous oxide	5.2 ₁	8.60	5.09
Cupric oxide		trace	
	100.62	99.17	100.92

YTTROTANTALITE (?).

According to Gen. Clingman, grains of this mineral have been found in several localities in the western counties. It is probably fergusonite or samarskite.

SAMARSKITE.

It has been found in the gold sands of Rutherford County, in small black grains and pebbles, sometimes weighing one-fourth of an ounce, which, when broken, had a vitreous resinous luster and a brownish black color, and a sp. gr. of 5.69. It is found also in the gold sands of Burke (at Capt. Mills's) and McDowell Counties. It has been analyzed by T. S. Hunt (I).

About 5 years ago large masses, one of them weighing more than 20 pounds, were found at Wiseman's mine, Mitchell County; usually in irregularly shaped pieces, sometimes coarsely crystallized, rarely in distinct modified rhombic prisms. The color is deep velvet black, in thin edges brown, the luster resinous, and the fracture conchoidal. Sp. gr., 5.72.

It has been analyzed by Miss Ellen H. Swallow (now Mrs. R. H. Richards) (II), J. L. Smith (III), and O. D. Allen (IV):

	I.	II.	III.	IV.
Columbic oxide				37.20
Tantallic oxide	54.81	54.96	55.13	18.60
Tungstic and stannic oxides		0.16	0.31	0.08
Uranic oxide	17.03	9.91	10.96	12.46
Ferrous oxide	14.07	14.02	11.74	10.90
Manganous oxide		0.91	1.53	0.75
Cerous oxide, etc	3.95	5.17	4.24	4.25
Yttria	11.11	12.84	14.49	14.45
Magnesia		0.52	trace.	
Lime				0.55
Loss by ignition	0.24	0.66	0.72	1.12
Insoluble		1.25		
	101.21	100.40	99.12	100.36

Dr. Smith expresses his doubts about the true nature of the cerous oxide, etc., separated from the samarskite. This mineral has lately been the subject of investigation by numerous chemists, and several new elements, samarium, etc., have been discovered in it. The nature of these has not yet been sufficiently established to understand their exact relations. Samarskite has also been found in small pieces of 1 to 3 ounces at the Grassy Creek mine, Mitchell County, and in McDowell County.

A mineral associated with samarskite, and probably a product of its decomposition, has erroneously been called euxenite.

It occurs in reddish brown and hair-brown masses, translucent in thin fragments and with irregular to subconchoidal fracture, a yellowish brown streak, and a resinous to subadamantine luster. Hardness, 5.5. It has been analyzed by J. L. Smith (I) and M. H. Seaman (II):

	I.	II.
Sp. gr.	4.593 to 4.642	4.33
Columbic oxide	54.12	47.09
Stannic and tungstic oxides	0.21	0.40
Yttria	24.10	13.46
Cerous oxide		1.40
Lanthana and didymia		4.00
Uranic oxide	9.53	15.15
Ferrous oxide	0.31	7.09
Manganous oxide	0.08	
Lime	5.53	1.53
Water	5.70	9.55
	99.58	99.67

RUTHERFORDITE.

In monoclinic crystals and grains of a blackish brown color and vitreo-resinous luster and conchoidal fracture. Sp. gr., 5.55-5.69.

A partial analysis by T. S. Hunt gave:

Titanic oxide	58.5
Lime	10.0
Not determined	31.5
	100.0

In the gravel deposits of Rutherford and Burke Counties.

These data give no clue to the identity of the mineral. It may be the same as the following.

FERGUSONITE.

Found by Hidden in July, 1879, at Mills's gold mine, Brindletown, Burke County. It occurs in small, reddish brown to brownish black, *tetragonal*, very acute pyramids, with basal and hemihedral planes,

generally covered with a gray crust. Also found by Hidden at the Wiseman mine, in Mitchell County, in fine crystals, but with nothing new as to form.

The Brindletown fergusonite has been analyzed by J. L. Smith (I) and J. W. Mallet (II), as follows :

	I.	II.
Sp. gr.....	5.87	.....
Columbic oxide.....	48.12	43.78
Tantalalic oxide.....		4.08
Stannic and tungstic oxides.....		0.76
Yttria.....	40.20	37.21
Cerous oxide.....		0.66
Lanthana and didymia.....		3.49
Uranic oxide.....	5.81	5.81
Ferrous oxide.....	2.75	1.81
Lime.....		0.65
Water.....	1.50	1.62
	98.38	99.87

POLYCRASE.

Discovered by Hidden in decomposing granite on the Davis land, not far from the zircon mine in Henderson County. It occurs in separate crystals, associated with zircon, monazite, xenotime, cyrtolite, and magnetite. More or less altered at the surface to a mineral resembling xanthitane or gummite; color, nearly coal black; sp. gr., 4.78. A partial analysis by Mackintosh gave as follows:

Columbic oxide.....	48.97	
Tantalalic oxide.....		
Titanic oxide.....		
Yttria, etc.....		27.55
Ferric oxide.....		3.19
Uranic oxide.....		13.77
Ignition.....		5.18
		98.66

Additional experiments gave columbic oxide, 28.52, and titanic oxide, 20.27. The same mineral also occurs near Marietta, South Carolina, which is in the same general region.

ROGERSITE.

In white mammillary crusts and little pearly beads upon samarskite at the Wiseman mine, Mitchell County. Sp. gr., 3.313.

It has been partially analyzed by J. L. Smith, who found :

	I.	II.
Columbic oxide.....	18.10	20.21
Yttria, etc.....	60.12	.....
Water.....	17.41	16.34

PHOSPHATES, ARSENATES, ETC.

XENOTIME.

In minute tetragonal pyramids, in the sands from gold washings in Polk, McDowell, Burke, and Rutherford Counties. In some sands which I have received from Capt. Mills's gold mine, in Burke County, there were a few peculiar crystals of a pale grayish or yellowish white color. They were tetragonal pyramids, but were irregular and rough on the planes, and appeared to inclose some foreign substance, perhaps zircon. One had a nucleus of a greenish yellow color and resinous luster, which resembled monazite. A few tests which have been made with a fragment of a crystal, which appeared pretty uniform in composition, gave reactions resembling those of zirconia, yttria, and phosphoric acid, with a minute trace of cerous oxide.

Some very fine crystals of xenotime have also been found by Hidden at a locality about 3 miles from the Emerald mine, in Alexander County; sp. gr., 4.52. He also verifies the Brindletown mineral, and reports it from the Davis land on Green River, in Henderson County. At both the latter localities the xenotime crystals are sometimes symmetrically compounded with zircon, like the crystals from Norway described by Zschau.

APATITE.

This is rather a rare mineral in this State. I have observed it in imperfect crystals of a grayish and reddish green color in orthoclase, etc., at Ray's mine, Hurricane Mountain, Yancey County, and in small granular patches of a greenish color in granite; found 3 miles south of the Blue Ridge, 16 to 17 miles from Jefferson, on the road to Wilkesborough; found also in greenish white crystals, often inclosing quartz, sometimes from 2 to 3 inches in length and nearly 1 inch in thickness, implanted in albite, at Point Pizzle and at Cox's mine, Mitchell County, and at the Presnel and Gugenheim mines, Yancey County.

Minute crystals of apatite of highly interesting forms, with many planes, are found at the Emerald and Hiddenite mine in Alexander County; and opaque, minute, hexagonal prisms with pyramidal and basal planes are found in cavities of orthoclase, associated with the zircons of Green River, Henderson County.

Prof. W. B. Phillips has described phosphatic deposits similar to those of South Carolina, but nowhere in sufficient amount to give full assurance of economic importance, in eastern North Carolina in the counties of Duplin, Brunswick, Pender, and others. The best deposits opened occur 4 to 8 miles northeast of Magnolia, in Duplin County, where they form thin, irregular beds from 8 to 12 inches in thickness in sand deposits from 3 to 5 feet below the ground.

PYROMORPHITE.

This is one of the most beautiful minerals found in North Carolina, and formerly was quite abundant at the Silver Hill mine, which furnished very handsome specimens of hexagonal prisms and crystalline aggregations of different shades from colorless to almost black, also honey and wax yellow, green, brown, etc.; less abundant, and mostly of a yellowish green color, it is found at Silver Valley, Davidson County. In green and yellowish green crystals at the Troutman and McMakin mines, in Cabarrus County; also at the Stewart mine, in Union County, and in minute green crystals in the gold veins of the Baker and Miller mines, Caldwell County.

MONAZITE.

It is found in considerable quantities in small, brown, greenish, or yellowish brown monoclinic crystals in the gold sands of Rutherford, Polk, Alexander, Burke, and McDowell Counties; also in the neighborhood of Crowder's Mountain, Gaston County, and at Todd's Branch, in Mecklenburg County, where it occurs in association with diamond, zircon, etc.

Very fine crystals over an inch long were found by Hidden in Mitchell County. It is also found in mica-schist at the Deake mine, Mitchell County; in feldspar at Ray's mine, Yancey County, and in large cleavable masses, sometimes 3 to 4 inches across and of a yellowish brown color, from Mars Hill, Madison County.

Monazite is especially abundant in the gold sands at Brindletown, Burke County. About 15 tons of a sand containing from 60 to 92 per cent of small crystals have been found, the color varying from wax yellow to cinnamon brown; sp. gr. 5.10. Analyzed by Penfield, in triplicate, as follows:

	I.	II.	III.
Phosphoric acid.....	29.45	29.20	29.20
Cerium oxide.....	31.38	31.94	30.77
Lanthanum oxide.....	} 30.67	30.80	31.17
Didymium oxide.....			
Thorium oxide.....	6.68	6.24	6.56
Silica.....	1.40		
Water, or loss by ignition.....	0.20	0.20	
	99.78		

The thoria is due to admixed thorite. About 3 miles east of the Alexander County emerald mine some exceptionally fine crystals of monazite were found, says Hidden, associated with smoky quartz, rutile, and xenotime. They were mostly transparent, highly polished, and of a fine essonite-red color. They varied from one fourth to one-

half an inch wide and from one-third to three-fourths of an inch long; sp. gr., 5.203. Penfield found in this monazite only 1.48 per cent of thorium.

VIVIANITE.

Found in dark bluish green, slender crystals, in a compact nodule of tertiary marl, in Edgecombe County; analyzed by W. B. Phillips, of the agricultural chemical station. It is a new and unnamed variety, resembling anglarite and ludlamite in its percentages of water (14) and iron oxide (56), but differing from both and occupying an intermediate position between them in containing equal percentages of both forms of the oxide—protoxide 28.05, sesquioxide 28.35. The normal *ferrous* oxide of vivianite is here, as usual, oxidized in part to the *ferric* form.

OLIVENITE.

Minute green crystals and brownish green, fibrous masses, associated with tetrahedrite, scorodite, etc., at George Ludwick's mine, in Cabarrus County, appear to belong to this species.

PSEUDOMALACHITE.

In reniform and fibrous masses, of a dark emerald green color, at the McGinn and Wilson mines, in Mecklenburg County; Cullen's mine, in Cabarrus County; Fisher Hill mine, in Guilford County; at Clegg's mine, in Chatham County, and about 1 mile from the Soapstone quarry, in Moore County; also at the Peach Bottom mine, in Alleghany County.

I have analyzed the pseudomalachite from the McGinn mine, which contains:

Phosphoric acid.....	24.58
Cupric oxide.....	68.60
Water	6.86
	100.04

LAZULITE.

In dark blue crystals and crystalline masses, in quartz, and associated with cyanite and muscovite at Crowder's and Clubb's Mountains, in Gaston County; also in quartz, and with very little muscovite, at Coffee Gap, in the Sauratown Mountains, Stokes County. That from Clubb's Mountain has been analyzed by Smith and Brush, who found in two analyses:

	I.	II.
Sp. gr.....	3.122	.....
Phosphoric acid	43.18	44.15
Alumina	31.22	32.17
Ferrous oxide.....	8.29	8.05
Magnesia	10.06	10.02
Water	5.68	5.50
Silica	1.07	1.07
	99.70	100.96

SCORODITE.

In small, leek green and yellowish green crystals, associated with tetrahedrite, quartz, etc., at George Ludwick's mine, in Cabarrus County. It is found in finely granular masses of a brownish or yellowish green color, associated with leucopyrite, from the oxidation of which it is formed, at Drum's farm on the White Plains, Alexander County, and at Dr. Halyburton's, in Iredell County.

WAVELLITE.

Globular and hemispherical aggregations of white and grayish white wavellite, associated with silver, galenite, pyrite, etc., are rarely met with at Silver Hill, Davidson County.

PHARMACOSIDERITE.

Exceedingly minute crystals of this mineral, of a brownish green color, are associated with the scorodite of George Ludwick's mine, Cabarrus County.

DUFRENITE.

It is rarely met with in grayish green tufts of silky luster with the so-called "black band" iron at Egypt, Chatham County.

PHOSPHURANYLITE.

In microscopic rectangular pearly scales or in pulverulent incrustations upon quartz, muscovite, and feldspar. Deep lemon yellow in color.

I have made an analysis of a specimen, which appears to have been slightly contaminated with cerussite, and found the composition, after deducting the plumbic oxide, as follows :

Uranic oxide.....	76.71
Phosphoric acid.....	12.08
Water.....	11.21

Associated with autunite and other uranium minerals at the Flat Rock mine and Buchanan mine, Mitchell County.

AUTUNITE.

In beautiful nearly square scales or small crystals of a greenish, yellow or yellowish green color, upon quartz and feldspar at the Flat Rock and other mines, Mitchell County. Hidden also reports it from Alexander County.

NITER.

Crystalline crusts on mica slate at Nantahaleh River, in Cherokee County.

TUNGSTATES, MOLYBDATES, ETC.

WOLFRAMITE.

In laminated masses with cuproscheelite and scheelite at the Cosby mine, and with barite at the Flowe mine, both in Cabarrus County; also, according to Gen. Clingman, frequently in Rutherford and Burke Counties.

I have made an analysis of the wolfram, which forms the nuclei in the rhombic tungstate of lime and found:

Ferrous oxide	19.80
Manganous oxide	5.35
Lime	0.32
Stannic oxide	trace
Tungstic oxide	75.79
	101.26

Sp. gr., 7.496.

RHOMBIC TUNGSTATE OF LIME.

Associated with wolframite, in barite, at the Flowe mine, in Cabarrus County, in small crystals and laminated masses of a yellowish and grayish color, which frequently contain a nucleus of wolfram.

SCHEELITE.

Orange-colored tetragonal pyramids are found at the Flowe mine; yellowish brown and grayish imperfect crystalline masses at the Cosby mine; also at Cullen's mine, Cabarrus County, in rounded granular patches of a grayish-yellow color, with auriferous pyrite in quartz. I have analyzed the latter and found them composed of:

Stannic oxide	0.13
Tungstic oxide	79.52
Cupric oxide	0.08
Ferric oxide	0.18
Lime	19.13
	99.22

CUPROSHEELITE.

In yellowish green and siskin green pulverulent coatings upon scheelite at the Cosby mine, Cabarrus County.

STOLZITE.

A few small tetragonal pyramids of a bluish gray, and one small, somewhat barrel-shaped crystal of a grayish yellow color of this very rare mineral have been found in a lump of quartz, associated with sphalerite, at Silver Hill, Davidson County.

SULPHATES, CHROMATES, ETC.

BARITE.

In small white tabular crystals, with pyromorphite and manganese ores at the McMakin mine, Phoenix mine, and White's mine, Cabarrus County. The laminated and coarsely granular white variety at the Flowemine and Orchard vein, in Cabarrus County; a vein of the coarsely laminated, grayish white barite, at the Latta mine, near Hillsboro', Orange County. It occurs coarsely granular, and has the appearance of white marble, at Ool. Walkup's, Union County. A vein of very white compact and granular barite of from 7 to 8 feet in width has been found at Crowder's Mountain, Gaston County; west of the Blue Ridge, a vein of 8 feet in width exists at Chandler's, 9 miles below Marshall, in Madison County, where it is white and grayish white in color, and of a granular structure, containing small patches of laminated barite; also on Elkin Creek, in Wilkes County.

ANGLESITE.

In small, tabular, rhombic prisms, with very few additional planes, in the brown, granular zincblende of Silver Hill, Davidson County; also, according to Gen. Clingman, at the Baker mine, in Caldwell County.

CROCOITE.

I have observed this rare mineral associated with gold and small quantities of galenite in small cavities of saccharoidal quartz from Nash County, in very minute, dark hyacinth red crystals.

MELANTERITE.

As the result of the decomposition of pyrite, disseminated through many of the mica slates, etc., of Rutherford, Cleveland, and other counties, melanterite or copperas is formed, but no good crystallized specimens have come to my notice.

GOSLARITE.

In the water of the Silver Hill mine; also in fine, fibrous, crystalline masses upon sphalerite, formerly at the McMakin mine, Cabarrus County.

CHALCANTHITE.

Very fine crystals, with granular and fibrous crystalline masses of sulphate of copper, were formerly obtained from the upper works of the Silver Hill mine, Davidson County, principally at the 60-foot level.

ALUNOGEN.

I have once seen a beautiful specimen of fibrous, silky alunogen from the western counties, but could not learn the exact locality from which it came. It is found abundantly associated with melanterite, in Rutherford, Cleveland, and other counties, but not in good specimens; also in Iredell and Catawba Counties.

MISY.

This mineral has been observed in association with galenite and pyrite, in pulverulent greenish yellow masses, at Flint Knob, Wilkes County.

MONTANITE.

This very rare tellurate of bismuth has been found with tetradymite at David Beck's mine in Davidson County, and at Captain Mills's, in Burke County. The yellow "oxide of bismuth," observed by Dr. Asbury at the Asbury vein, in Gaston County, may belong to this species.

An analysis which I have made of that from Davidson County gave:

Ferrie oxide	1.26
Cupric oxide	1.04
Bismuthic oxide	68.78
Telluric acid	25.45
Water	3.47

100.00

CARBONATES.

CALCITE.

Perfect crystals are found at Whiteville, Columbus County, in marl, in the Clegg mine, Chatham County, and at the Emerald and Hiddenite mine, in Alexander County. It occurs coarsely granular in a vein at Hoover's mine, about 6 miles from Silver Hill; at Moore's mine, 10 miles southeast of Lexington; in Ore Knob mine, Ashe County; and rarely at Silver Hill, in Davidson County, and the Steele mine, Montgomery County. Small quantities of granular calcite were found in digging a well at Morrisville, Wake County. The granular varieties, which constitute marble, are sometimes found associated with the compact varieties of limestone in the band which passes through North Carolina, from Stokes County through Catawba, Lincoln, and Gaston Counties; as, for instance, at the quarries of Martin on Snow Creek; of Bolejack, near Germanton, in Stokes County; Pfaff in Forsyth; Hooper, in Catawba; and Stowe, in Lincoln County, and in the Eocene limestone of New Hanover County. A coarse, granular limestone occurs also at Goshen and at Haskett's, on Ellijay Creek, Macon County, and on Cullowhee Creek, Jackson County, again on Bear Creek and Walnut Creek and at Marshall, in Madison County. A veined gray

and white marble is found at Powell's quarry, near Catawba station, Catawba County. Very beautiful varieties of white, pink, and gray marble are found abundantly at the Nantahaleh River, Marble Creek, Valley River, and other places in Cherokee County. A band of compact limestone, sometimes finely granular, is found in Turkey Cove and Cedar Cove and on Linnville Mountain and Graveyard Mountain, in McDowell County; also in Jackson, Transylvania, and Henderson Counties, and at Warm Springs and on Shut In Creek and Laurel River, Madison County. It is also found in small seams and crystalline grains, replacing in part the orthoclase of a massive granite gneiss in Harnett County.

DOLOMITE.

Dolomite of a grayish white color, resembling marble, is found on Valley River, 10 miles from Murphy, Cherokee County; and in magnificent rhombohedral crystals, often coated with hisingerite, at the Emerald and Hiddenite mine in Alexander County.

MAGNESITE.

The lamellar white and grayish variety, from which distinct cleavage crystals can be obtained, is found at McMakin's mine, Cabarrus County; also, with chrysolite at Webster, Jackson County, and Hampton's, Mining Creek, Yancey County. At the latter locality are also found the white compact, and at Webster the white earthy and pulverulent varieties. Breunnerite occurs in serpentine, 4 miles south of Morganton, Burke County, and near Dobson, Surry County.

SIDERITE.

In fine rhombohedral crystals at the Emerald and Hiddenite mine, and also formerly at the McCulloch, the North Carolina, and several other mines in Guilford County, where it occurred in considerable masses in the vein. In the same manner it is of frequent occurrence in many of the gold veins of the State, especially in those which carry copper. It often forms almost the whole mass of the veins, frequently, however, decomposed into limonite, which still retains its rhombohedral form; for instance, at Conrad Hill in Davidson County, in Gaston County, at some of the mines in Randolph County, and at the Cosby mine in Cabarrus county. In smaller quantities it has been observed in Stokes County and in some of the mines in Mecklenburg and Alexander Counties. A white cleavable variety occurs at the Budisill mine, near Charlotte. The earthy and argillaceous varieties of siderite form large beds in the Triassic coal strata and constitute the so-called black band or ball ore at Farmville, Egypt, the Gulf, etc., in Chatham County. It is also found in compact, grayish brown nodules in Halifax and Granville Counties.

RHODOCHROSITE.

In small globular pink and rose-red concretions, with earthy manganese, near Franklin, in Macon County; also mixed with magnesite, talc, etc., in compact and granular masses, at the McMakin mine, Cabarrus County.

•
CERUSSITE.

The most beautiful crystallizations, single individuals as well as twins, were found at Silver Hill, immediately after the discovery of the mine; also white, yellowish, and greenish white, compact varieties, frequently highly argentiferous. A very interesting occurrence at the same mine is cerussite, pseudomorphous after pyrite. Yellowish white columnar cerussite occurs in Gaston County. Rhombic prisms with pyramidal planes, together with imperfect crystallizations and earthy masses, are found at Clegg's mine, Chatham County. At Elk Creek, in Wilkes County, earthy cerussite has been observed coating galenite. It is also found at Baker mine in Caldwell County, and at Murphy, Cherokee County.

MALACHITE.

Malachite, in its varieties, fibrous, compact, and earthy, being the result of the decomposition of other copper ores, is found in association with the latter in almost every copper mine in the State. The Guilford, Cabarrus, and Mecklenburg County copper mines contain it. I have observed the fibrous variety at Silver Hill and Conrad Hill, in Davidson County; the Gillis mine, in Person County; the Cheek mine, in Moore County, and both the fibrous and earthy malachite at Clegg's mine, in Chatham County. It has been found in the Brushy Mountains, Alexander County; the Peach Bottom mine, Alleghany County; the Ore Knob mine, in Ashe County; the Gap Creek mine, in Watauga County; the Cullowhee, Savannah, and Waryhut mines, in Jackson County; near Sassafras Fork, in Granville County, and at many other localities too numerous to be mentioned. Pseudomorphs of malachite, after cubical cuprite, have been found at Cullen's mine, Cabarrus County.

AZURITE.

This variety of carbonate of copper is far less frequently met with. Small but very beautiful and perfect crystals are found at Clegg's mine and at Snipes's (iron) mine, in Chatham County, and at the Cheek mine, in Moore County. It is rare at the Cullen and Boger mine in Cabarrus County, the Wilson mine in Mecklenburg County, and at Wells's, Gaston County.

BISMUTITE.

In yellowish white concretions, often of a pearly luster, or white incrustations upon gold-bearing quartz, at the Asbury mine, in Gaston County, where it was discovered by Dr. Asbury.

Bismutite has also been found in a narrow vein in Casher Valley, Jackson County, in small masses, the largest of the size of a pigeon's egg, of a light apple-green or dark gray, through yellow to light gray masses which are chalky white in the amorphous parts. Laminated, sometimes almost columnar. Sp. gr., 7.4 to 7.5. The analyses by Dr. A. H. Chester gave:

	I.	II (the pure).
Bismuthic oxide	86.36	89.80
Carbonic dioxide	7.79	8.10
Water	2.02	2.10
Insoluble	3.6	.....
	99.80	100.00

Quite recently (January, 1888) I have received the same mineral from Rev. C. D. Smith, from Highlands, Macon County, where it occurs in amorphous, grayish white masses, associated with beryl, muscovite, etc.

MINERAL COAL.

ANTHRACITE.

A very interesting occurrence of anthracite is that of masses with conchoidal fracture in the vein rock at the Clegg mine in Chatham County. The bituminous coal, both of the Deep and Dan Rivers, is frequently, especially near trap dikes, almost deprived of its hydrocarbons, often approaching true anthracite.

BITUMINOUS COAL.

The greater portion of the coal in the Deep River beds is bituminous coal, the volatile matter varying from about 8 to 32 per cent. The Dan River coal, which I had opportunity to examine, is so-called semi-bituminous coal, that from near Stokesburg, Stokes County, containing about 10 per cent of volatile matter.

LIGNITE OR BROWN COAL.

Frequently met with in the marl beds of the eastern counties, and in the Trias of Granville County, on Tar River, and on Brown's Creek, Anson County.

ORGANIC COMPOUNDS.

SUCCINITE (AMBER).

Found in lumps of several ounces weight in Pitt County and elsewhere, in the Tertiary marl beds of the eastern counties.

SYNOPSIS OF MINERALS AND MINERAL LOCALITIES, BY COUNTIES.

ALAMANCE.

- Graham.*—McAden mine: Gold; pyrite; actinolite.
Newlin's.—Gold; pyrite; chalcopyrite.
Holt mine.—Gold; also at Anthony mine.
Dixon's mine.—Gold on both sides of Haw River, in placers; Boyd mine, in placers.
Cane Creek Mountains.—Gold; epidote; chalcedony; magnetite.
Near Cane Creek Factory.—Pyrophyllite; halloysite.

ALEXANDER.

- White Plains.*—Scorodite; columbite; tourmaline (Lackey's and Price's); beryl (at Warren's, Lackey's, and Price's); rose quartz; smoky quartz, also near Taylorsville; rutile in geniculated crystals, and acicular crystals in limonite and in quartz; the latter also near Poplar Springs; spodumene, in emerald and yellowish green crystals (hiddenite), in Sharpe's township.
Barrett Mountain.—Graphite.
Price and Keever place.—Beryl; tourmaline; columbite; autunite; muscovite.
Lead mine.—Amethyst.
Roseman's farm.—Milky quartz.
Little River.—Tourmaline.
Hiddenite Post-office.—(The Emerald and Hiddenite mine)—Emerald (!); beryl (!); monazite in fine crystals (!); spodumene, transparent, green, and yellowish crystals (!); apatite; calcite; dolomite (!); siderite; rutile (!); muscovite (!); hisingerite; tourmaline.
Taylorsville.—Three miles distant, smoky quartz; rock crystal; tourmaline; beryl.
Headwaters of Snow Creek.—Foliated talc; hematite.
Bend of Catawba River.—Pyrope garnets.
Marshall's farm.—Garnets.
Brushy Mountains.—Malachite; chalcopyrite; graphite; asbestos; tabular quartz.
Elsewhere.—Green, brown, and black tourmaline; graphite; magnetite; tantalite; beryl, yellow, blue, green; quartz crystals with basal

plane, also with other singular modifications, also smoky, yellow, and milky; monazite, var. turnerite; asbestos; pyrite; magnetite; chalcopyrite; pyrolusite; limonite, pseudomorphous after siderite; siderite; kaolinite; orthoclase, large crystals (one of 40 pounds); biotite; muscovite; rutile, very fine at Milholland's mill and at Robt. Johnson's; tourmaline at B. Lyon's, with unusual terminal angles (Hidden).

ALLEGHANY.

Peach Bottom mine.—Pyrite; chalcopyrite; malachite; galenite; cuprite; sphalerite; molybdenite.

Roaring Gap.—At H. Harris's, chalcopyrite (auriferous); bornite.

T. Bryan's.—Pyrite.

Bullhead Mountain.—Cyanite; magnetite; garnet.

Elsewhere.—Graphite; chrysolite; gold, in placers; martite; pyrite; calcite; zoisite; smoky quartz.

ANSON.

Boggan's Out.—Calcite; serpentine; rock crystal and cellular quartz; lignite.

Mill Creek.—Muscovite.

Peedee Station.—Orthoclase.

Farm of T. J. Pack.—Siderite; chalcopyrite; quartz.

Wadesboro'.—Two miles south, gold in vein.

Elsewhere.—Quartz crystals of considerable size, at several points.

ASHE.

Blue Ridge, south of Jefferson.—Muscovite; black tourmaline.

Horse Creek.—At Hampton's: epidote; magnetite; manganese garnet.

At Graybill's: magnetite; epidote.

Helton Creek, near mouth.—Magnetite at Ballou's.

Ore Knob mine.—Pyrite; calcite; chalcocite; arsenopyrite; malachite; metallic copper.

Jefferson.—Chalcopyrite, 2, 3, and 6 miles distant, and at Mulatto Mountain; graphite in gneiss; chlorite at Willis's mine; hyalite at Foster's mica mine; muscovite, beryl, and garnet at Little Phoenix mica mine; kaolin; tourmaline, 7 to 8 miles southeast; chrysolite, 6 miles east on New River.

Three Top Mountain.—Tremolite.

New River (South Fork, near mouth).—Chrysolite; chalcopyrite, magnetite.

Gap Creek (Copper Knob mine).—Gold; silver; hematite; epidote; bornite; chalcocite; chalcopyrite; chrysocolla; malachite. On Gap Creek: cyanite; hornblende.

Shady Spring.—Asbestos.

Elk Knob.—Chalcopyrite; epidote.

Phoenix Mountain.—Rock crystal (!).

Witherspoon mine.—Asbestiform actinolite.

Elsewhere.—Azurite; cuprite; actinolite; talc; chlorite; asbestos; graphite.

BEAUFORT.

Siderite, in nodules; calcite in marl beds, and in the Eocene (bottom of Pamlico River, and on Blount's farm); pyrite.

BERTIE.

Calcite, in marl beds.

BLADEN.

Calcite, in marl beds.

BRUNSWICK.

Calcite, in marl beds; glauconite, in green sand; phosphatic nodules.

BUNCOMBE.

Asheville.—Meteoric iron (!); garnet; magnetite, at L. W. Sams's; ferrous chloride (!), in the meteorite; ochreous hematite; hornstone; serpentine; barite (!), granular, on Fox Branch, 10 miles below Asheville; on road to Burnsville, 14 miles north, chrysolite; 17½ miles north, hornblende; 19 to 20 miles north, pyrrhotite; magnetite; hematite; corundum with hornblende and calsageeite; serpentine; prochlorite; asbestos; actinolite; kaolin; jefferisite.

Big Ivy.—Genthite, with chrysolite.

Black Mountain.—Almandite garnet; eyanite at Bowlen's Pyramid.

Flat Creek.—Foliated graphite in gneiss.

New Found Mountains.—Biotite.

Balsam Gap mine.—Allanite (!); beryl; muscovite; biotite; albite; black garnet; columbite; tourmaline.

Cane Creek.—Calcite; gold; hematite; limonite.

Ivy River.—Chrysolite; chromite; hornstone; genthite; talc; asbestos; tremolite.

Brushy Mountain mine.—Muscovite; kaolinite; orthoclase; albite.

Ream's Creek.—Garnet, large crystals.

Burnet mine.—Muscovite; orthoclase crystals, large (100 to 1,000 pounds).

N. P. Watkins's.—Corundum; cyanite; muscovite; tourmaline; garnet.

French Broad River.—Six miles north of Asheville, meteoric iron (!).

Hominy Creek.—Biotite.

Pisgah Mountain.—Ten miles southwest of Asheville, meteoric iron (!)—

Turkey Creek.—Limonite; magnetite; chlorite; talc.

Swannanoa Gap.—Corundum in cyanite (!); muscovite; 2 miles southwest from gap, limonite; hornblende, one-quarter mile northwest; tourmaline, one-quarter mile west.

Swannanoa River.—Near Asheville, meteoric iron (!) with troilite; actinolite; black hornblende; beryl; 7 miles above Asheville, hematite; 9 miles east of Asheville, serpentine.

George Alexander's.—At mica mine: beryl; muscovite; kaolinite.

Elsewhere.—Gold; tourmaline; massive, 6 miles south of Asheville and on French Broad, near Buck Shoal; garnet; hematite; galenite, at L. Fortune's; muscovite in many mica mines; beryl, blue; talc; columbite; garnet; menaccanite; bed of limonite, at Blackwell's, 12 miles west of Asheville; chrysolite; graphite.

BURKE.

Brindletown.—At Mills's gold mine, crystallized gold; tetradymite; montanite; brookite; anatase; rutile; zircon; malacon; cyrtolite; monazite; xenotime; samarskite; columbite; fergusonite; hydrofergusonite; adelpholite (!); menaccanite; hematite; magnetite; chromite; limonite; pyrite; titanite; cyanite; fibrolite; corundum; muscovite; vermiculite; enstatite; hornblende, green and black; steatite; tourmaline, green and black; orthoclase; albite; zoisite (!); garnet; actinolite; beryl; talc; asbestos; quartz, clear, smoky, and amethystine; psilomelane; arsenopyrite (!); allanite; thorite; diamond. (This list is furnished by W. E. Hidden, and includes all discoveries to the close of 1889.)

Bear's Knob.—Corundum with muscovite, 4 miles southeast.

Brown Mountain.—Platinum, on Gen. Hoke's farm; fluorite; limonite; magnetite; albite; kaolinite; gold, in placers.

Linnville Mountain.—Menaccanite; hematite; itacolumite (!); radiated pyrophyllite; limonite; graphite; meteoric iron.

Bridgewater.—Manganese garnet; gold.

Morganton.—Lead, 4 miles north; graphite, at Morganton and 6 miles south; corundum altered to muscovite; quartz crystals; titanite at Morganton Springs; pyrite; garnet; magnetite; chlorite (!).

Pax Hill.—Gold (!); galenite.

Scott's Hill.—Gold; silver; cerargyrite; psilomelane; zircon; pyrite.

Shoup's Ford.—Beryl; garnet; corundum, in part altered to fibrolite (!); gold; magnetite; menaccanite; cyanite; tourmaline.

South Mountains.—Quartz crystals, inclosing liquid (!); garnet in trapezohedral crystals (!); granular hornblende; graphite, 8 miles southeast of Morganton; at Col. Gaither's 12 miles south of Morganton, gold in veins and placers; beryl (!), yellowish green and deep green (aquamarine), 9 miles southeast of Morganton; tourmaline (!), 16 miles southeast of Morganton; 4 to 6 miles south of Morganton, serpentine; talc; chlorite; actinolite; hematite; magnetite; asbestos; magnesite; breunnerite; chrysolite; garnet; tremolite; corundum, on lands of North Carolina State Company; arsenopyrite.

- Piedmont Springs*.—Four miles west, tourmaline.
Glen Alpine Springs.—Talc.
White's Knob.—One mile south, yellow ocher.
Sugar Mountains.—Quartz crystals, with double terminations, etc.; asbestos; gold; rutile; magnetite; beryl.
R. Havenar's farm.—Tourmaline; muscovite.
J. Huffman's farm.—Beryl; epidote; actinolite.
Laurel road.—Nine miles from Morganton; garnets, large.
J. London's farm.—Epidote; garnet; pyrite; gold.
Tate's farm.—Gold in placers.
G. Deitz's farm.—Beryl; tourmaline; albite; sagenite.
Hildebrand's farm.—Sagenite; beryl; asbestos; rutile.
Van Horn's farm.—Quartz crystals, inclosing fluid; quartz crystals, with basal plane; quartz crystals, smoky; sagenite; garnet.
 (The last eight localities are furnished by Humphreys.)
Elsewhere.—In the gold gravel and sands of the county occur gold; palladium (?); corundum; menaccanite; chromite; rutile; anatase; brookite (!); pyrope; zircon (!); epidote; tourmaline, black and green; fibrolite; xenotime (!); monazite (!); wolframite (?); limonite; magnetite; hematite.

CABAREUS.

- Gold in many veins and placers; meteoric stone; sulphur; chalcopryrite; magnetite; limonite.
Daniel Barnhardt's farm.—Barnhardtite.
Barringer's mine.—Gold; arsenopyrite.
Boger's mine.—Tetradymite (!); chalcopryrite; azurite.
Concord.—Rose quartz; hyalite; agate (also at Harrisburg); chalcopryrite; malachite; gold; bornite; asbestos, in rose quartz; tourmaline; magnetite; galenite.
Cosby's mine.—Stilpnomelane (?); wolframite; scheelite (!); cuproscheelite; siderite; barite.
Cullen's mine.—Tetradymite (!); cuprite in cubes (!); pseudomalachite; scheelite (!); malachite, in part pseudomorphous after cuprite (!); azurite.
Flowe's mine.—Wolframite (!); rhombic tungstate of lime (!); scheelite (!); barite.
Near Gold Hill.—Manganese garnet; magnetite.
House's mill.—Hematite.
George Ludwick's mine.—Gold; arsenopyrite (!); tetrahedrite (!); scorodite (!); pharmacosiderite; olivenite; pyrite; chalcopryrite.
McMakin's mine.—Silver; argentite; galenite; sphalerite; proustite (?); tetrahedrite, var. freibergite (!!); pyrolusite; pyromorphite; barite; goslarite; rhodochrosite; magnesite; calcite; wad; barite; talc.
Harrisburg.—Quartz crystals; agate.

Phoenix mine.—Gold; tetradymite (!); in Orchard vein, barite; pyrite; chalcopyrite.

Love mine, North Barrier, Furness, Elwood, and No. 3, a group of mines around Phoenix.—Gold; pyrite; chalcopyrite.

Long's mine.—Gold; pyrite; chalcopyrite; galenite.

Crowell's mine.—Gold; pyrite; galenite.

Newell mine.—Gold; pyrite; chalcopyrite.

Pharr mine.—Gold, in veins and placers; pyrite; chalcopyrite.

Fisher mine.—Near Concord: gold; pyrite; chalcopyrite.

Blackwelder mine.—Gold.

Barrier mines.—North, Middle and South Barrier: Gold; pyrite.

California mine.—Gold; pyrite.

Pioneer mills.—Molybdenite; chalcocite; chalcopyrite; barnhardtite; molybdenite; chrysocolla.

Reed's mine.—Gold (!!).

Troutman's mine.—Sphalerite; pyromorphite.

Union mine.—Copper in arborescent crystals (!) and plates; chalcocite; chalcopyrite; cuprite (!), in octahedra; malachite, fibrous.

White's mine.—Chalcopyrite; aikinite (?).

Elsewhere.—Gold; pyrite; agate; barite; galenite; sphalerite; magnetite; steatite.

CALDWELL.

Baker's mine.—Galenite; serpentine; picrolite; chrysotile (!); chrysotile; pyromorphite; anglesite; cerussite; asbestos; marmolite; psilomelane; chromite.

Buffalo River.—At Patterson's mill: pyrite in quartz.

Lenoir.—Magnetite; native sulphur in quartz (!); psilomelane, 4 miles west; asbestos, 6 miles east; hornblende, 6 miles west; amianthus, 15 miles northwest.

King's Creek.—Asbestos; anthophyllite; steatite.

Puett's.—Kaolinite.

Little John mine.—Gold (!); galenite; graphite.

Miller's mine.—Gold; galenite; pyromorphite.

Fort Defiance.—Tourmaline; beryl; graphite; garnet.

Patterson.—Magnetite; hematite; menaccanite; compact serpentine.

Wilson's Creek, near mouth.—Serpentine; talc.

Upper Creek.—Gold; tourmaline; limonite.

Near Grandmother Mountain.—Gold in placers; pyrite; quartz.

Tuttle's mine.—Gold in placers.

Richlands.—Magnetite; hematite; chlorite; serpentine; talc; martite.

Middle Little River.—Limonite; paragonite (?); muscovite; hematite.

Lower Creek.—Gold, in the gravel of most of its tributaries below Lenoir.

Elsewhere.—Gold, in placers and veins; sulphur; cuprite; pyrite; quartz crystals; epidote; muscovite; orthoclase; cyanite; malachite;

tourmaline; paragonite (?), common in schists; muscovite; hematite; limonite; chlorite; tremolite.

CAMDEN.

Calcite in marl beds.

CARTERET.

Calcite in marl beds.

CASWELL.

Meteoric iron (!); garnet; magnetite; pyrite.

Leasburg.—Albite (?), 3 miles west of Leasburg; fibrous tourmaline (!); chlorite; epidote.

CATAWBA.

Ball Creek mine.—Magnetite; kaolinite.

Roberson mine.—Magnetite.

Abernathy mine.—Magnetite.

Littlejohn's mine.—Limonite; hematite.

Hickory.—Graphite, crystallized; pyrite (!); alunogen; wad; amphibole; hematite; pyrolusite; limonite; quartz crystals; amethyst (!); garnet (!); muscovite; pyrrhotite; magnetite; chalcopyrite; calcite and pyrrhotite near Hickory; graphite, 2 miles southwest.

Hooper's quarry.—Granular calcite; pyrite; gold; graphite; tremolite.

Newton.—Kaolin; magnetite, at the Barringer mines; pyrite; tabular quartz, 6 miles west and 10 miles northeast of Newton.

Keeversville.—Quartz crystals; muscovite.

Ramscur's.—Muscovite.

Powell's quarry.—Calcite, granular (!); pyrite.

Shuford's mine.—Gold; pyrite.

Shuford's quarry.—Calcite; magnetite; rose quartz; amethyst.

South Mountains.—Graphite; cyanite; garnet.

Anderson's Mountain.—Magnetite; calcite; at Avery Shuford's, actinolite.

Forney's mine.—Magnetite.

Beard's mine.—Magnetite.

Powell's factory.—Manganese garnet.

Elsewhere.—Gold, in placers and veins; graphite; rutile, in acicular crystals in amethyst (!); rock crystal (!); quartz crystals inclosing liquid (!); beryl (!); garnet (!); cyanite; kaolinite; alunogen; wad; rutile in quartz (sagenite), at D. Lutz's; beryl; paragonite (?), common in the schistose rocks.

E. Balch's farm.—Muscovite; garnets; amethyst; smoky quartz crystals containing liquid; crystals of quartz with basal plane; graphite; black and brown tourmaline; rutile (acicular); beryl (blue, green, yellow); feldspar.

H. Balch's farm.—Liquid-bearing quartz crystals; gold; sagenite.

Widow Balch's farm.—Sagenite; liquid-bearing quartz crystals, with basal plane; tourmaline; rose quartz.

Rev. Huffman's farm.—Tessellated quartz crystals; same, liquid bearing; menaccanite; sagenite.

Spencer's farm.—Quartz crystals doubly terminated; same, liquid-bearing; same, inclosing mica; same, with asbestos; same, with pyrite; rutile in quartz crystals; amethyst; cyanite; tourmaline; magnetite.

Near Canova.—Smoky quartz crystals, large; crystals of amethyst, doubly terminated, inclosing rutile (yellow).

CHATHAM.

Buckhorn.—Hematite, foliated, granular, and micaceous; magnetite; rutile in quartz; manganese garnet; muscovite; psilomelane; limonite; epidote.

Carbonton.—Pyrophyllite slate (!)

Olegg's mine.—Galenite; bornite; chalcopyrite; pyrite in cubo-octahedra; cuprite; chrysocolla; pseudomalachite (!); cerussite (!); malachite (!), fibrous and earthy; azurite; anthracite; calcite; galenite; prochlorite (!).

Deep River.—Pyrophyllite slate (!); anthracite; bituminous coal.

Egypt.—Siderite (black band and ball ore); dufrenite (!)

Evans's mine.—Hematite; chloritoid in pyrophyllite slate.

Unthank's mine.—Magnetite.

Farmville.—Siderite (!) (black band and ball ore); bituminous coal.

Gulf.—Siderite (black band and ball ore); bituminous coal; limonite.

Lockville.—One-half mile above Lockville, hornstone; 7 miles west of Lockville, foliated and micaceous hematite; 6 miles southeast of Lockville, fine granular and compact hematite; 4 miles southeast, Garnet.

Kelly's ore bed.—Hematite (!)

Glass's mine.—Magnetite.

Pittsboro.—One-half mile west, kaolin; 6 miles south, on Rock Creek, Chalcopyrite (!); at Gum Spring, limonite, pseudomorphous after pyrite; 7 miles west, kaolin; 10 miles southwest, micaceous hematite; 16 miles west (R. J. Powell's), hematite; magnetite.

Fearrington's mill.—Three miles west, hematite.

Lindley's mine.—Gold; pyrite; chalcopyrite.

Harper's Cross-Roads.—Kaolin.

Healy's Bridge.—One mile east, wad.

Ore Hill.—Hematite, compact, foliated, and micaceous; limonite (!); magnetite.

Cane Creek.—Gold, in veins; pyrite.

William's mine.—Galenite; chalcopyrite.

Battle's Dam.—Rose quartz; hematite; garnet; psilomelane,

Snipes's mine.—Magnetite; epidote; chrysocolla; azurite.

Danelly's Creek.—Gold; pyrite; chlorite.

Elsewhere.—Gold, in placers and veins; chalcopyrite, mouth of Rocky River; pinite; halite in brine; amethyst; kaolin; halloysite.

CHEROKEE.

Hanging Dog Creek.—Tourmaline; limonite; staurolite.

Marble Creek.—Tremolite; talc; calcite, (granular), white, pink, gray (!).

Murphy.—Galenite; pyrolusite; limonite (!); wad; tremolite; talc (!); cerussite; at Number Six mine, calcite; tremolite; gold; galenite (argentiferous).

Nantehaleh River.—Niter in slates; calcite (!), granular, white, and pink; talc, massive white.

Parker mine.—Staurolite (!); gold; garnet.

Peachtree Creek.—Hematite; garnet; biotite; limonite; asbestos; red ocher; talc.

Valley River.—Hematite; phlogopite; talc; calcite (granular); dolomite; yellow ocher; limonite; gold, in placers; staurolite; corundum in cyanite, half way between Murphy and Valletown.

Brasstown Creek.—Gold in veins and placers; calcite; limonite.

Notteley River.—Limonite; calcite; talc; staurolite; garnet.

Valletown.—Rutile; at Whittaker's, brown ocher.

Number Six mine.—Tremolite; calcite.

Beaverdam Creek.—Smoky quartz (at mouth of Creek).

Elsewhere.—Gold in placers; cyanite, more or less altered to muscovite; staurolite (!); pseudomorphs of muscovite after staurolite. The staurolite localities are $11\frac{1}{2}$, $15\frac{1}{2}$, and 17 miles west of Murphy, and 11 miles from Ducktown, on the Morganton road.

CHOWAN.

Calcite, in marl beds.

CLAY.

Oullakenee mine, Buck Creek.—Corundum (!), white, gray, pink, and ruby, frequently altered into other minerals; spinel (!), rare; chromite (!) drusy quartz; black hornblende or arfvedsonite (!); smaragdite; chrysolite (!); zoisite (!); andesite (!); labradorite (!); orthoclase (!) tourmaline; serpentine, massive and variety picrolite (!); willcoxite; margarite (!); talc; albite; cyanite; enstatite; augite (?); prochlorite.

Brasstown.—Micaceous hematite.

Shooting Creek.—Corundum (!); pseudomorphous quartz after feldspar (?); actinolite; chrysolite; talc; prochlorite; willcoxite (!); margarite; rock crystal; magnetite; cyanite; muscovite; gold in placers; rutile in black crystals; garnet; pyrite; chalcopyrite; micaceous hematite; limonite; prochlorite (?).

Tusquittah Creek.—Gold in placers and veins; staurolite; rutile.

Tipton's.—Corundum; cyanite (green); muscovite.

CLEVELAND.

Whiteside mine.—Gold in placers.

Mountain mine.—Rock crystal (!); tourmaline (!); garnets; gold in placers; graphite; arsenopyrite; galenite; muscovite (!); melanterite; alunogen; pyrite, abundant in gneiss and mica schists; tourmaline.

Cleveland Mills.—Two miles distant, limonite.

Shelby.—Within a few miles, muscovite in large plates; magnetite; actinolite; tourmaline.

Double Shoals.—Arsenopyrite.

COLUMBUS.

Calcite, in marl beds; near Whiteville, in crystals.

GRAVEN.

Calcite, in marl beds; glauconite, in greensand.

CUMBERLAND.

Petrified wood, Fayetteville; calcite, in marl bed; lignite, limonite.

CURRITUCK.

Calcite, in marl beds.

DARE—(None.)

DAVIDSON.

Cid mine.—Chalcocite.

David Beck's mine.—Tetradymite (!); montanite (!).

Boss's mine.—Galenite, coarse grained.

Conrad Hill.—Chalcopyrite; hematite; limonite; siderite; malachite; barite.

Allen mine.—Gold; pyrite; chalcopyrite; arsenopyrite; tetradymite.

Emmons's mine.—Chalcopyrite; pyrite.

Loftin mine.—Chalcopyrite; pyrite.

Miller's mine.—Sphalerite; chalcopyrite.

Harris's mine.—Gold; pyrite; chalcopyrite.

Moore's mine.—Galenite; pyrite; calcite.

Silver Hill.—Silver (!); argentite; highly argentiferous galenite (!); sphalerite (!); chalcocite; pyrite; chalcopyrite; cuprite; melaconite; zoisite (!); orthoclase (!); calamine; pyromorphite (!); green, yellow, brown, black, and colorless; wavellite (!); stolzite (!); anglesite (!); goslarite; chalcanthite (!); calcite; cerussite (!) in fine crystals, massive and in pseudomorphs after pyrite; malachite.

Thomasville.—Epidote; muscovite; biotite; magnetite; augite.

Silver Valley.—Galenite; sphalerite; pyromorphite.

Uharrie River.—Sphalerite.

Russell mine.—Gold; pyrite.

Ward's mine.—Gold; electrum(!); pyrite; chalcopyrite.

Delk mine.—Gold; limonite; hematite; pyrite.

Laughlin mine.—Gold; limonite; hematite; pyrite.

Miller mine.—Gold; pyrite; limonite; hematite.

Brown mine.—Gold; pyrite.

Midway.—Gold; pyrite; chalcopyrite; chalcedony; hornstone.

Lick Creek.—Meteorite.

Elsewhere.—Gold, in veins and placers; titaniferous magnetite.

DAVIE.

Magnetite; hematite, in several localities in beds; calcite, granular, on Yadkin river.

DUPLIN.

Calcite, in marl beds; limonite; glauconite; pyrite; lignite.

Near Magnolia, phosphatic beds.

DURHAM.

Durham.—Pyrite.

Near Knap of Reeds.—At James Woods's hematite (!); magnetite (!); steatite.

Red Mountain.—Epidote.

EDGECOMBE.

Vivianite, in marl; limonite; glauconite; pyrite; lignite; kaolinite, near Battleboro; calcite in marl beds; radiated and tabular quartz at Rocky Mount.

FORSYTH.

Plaff's quarry.—Calcite, granular.

Near Salem.—Magnetite, four miles south; manganese garnet; halloysite; hematite; micaceous hematite; graphite; emery variety of corundum; wad; halloysite.

Old Town.—Orthoclase; halloysite; asbestos; hematite; kaolin; talc.

Near Kernersville.—Enstatite, var. bronzite; chrysolite; tourmaline; magnetite; hematite; chlorite; pyrite.

Brookstown.—Calcite; tremolite.

Elsewhere.—Titaniferous magnetite (!); gold; also pure magnetite (!); serpentine.

FRANKLIN.

Portis mines.—Gold in placers (!); diamond (!); muscovite, in large plates; magnetite; asbestos; tabular quartz.

Franklin.—Kaolin.

Near Louisburg.—Halloysite; asbestos; tabular quartz.

Mann Arrington mine.—Franklinite (?).

Laurel.—Muscovite.

GASTON.

Asbury's mine.—Silver; tetradymite; galenite; pyrrhotite; pyrite; leucopyrite; auriferous arsenopyrite; bismite; scorodite; montanite(?); cerussite; bismutite (!).

Cansler and Shuford mine.—Gold (!); galenite.

Clubb's Mountain.—Corundum, red and blue (!), also mammillary (Dr. Hunter); rutile (!!); tourmaline, granular and fibrous; leopardite; cyanite (!); pyrophyllite (!); muscovite (!); lazulite (!); talc; quartz crystals; margarite; hematite; muscovite; manganese garnet; magnetite; gold; iron garnet.

Clear Mountain.—Lazulite.

Crowder's Mountain.—Corundum, red and blue (!), also variety emery; rutile (!); in crystals and granular; gold; menaccanite; cyanite (!); topaz (?); pyrophyllite (!); muscovite (!); monazite; lazulite (!); barite, with galenite (argentiferous); hematite; limonite; sphalerite; tourmaline; pyrite; chalcopyrite; manganese garnet; pyromorphite.

Yellow Ridge.—Magnetite.

Stowe's Factory.—Magnetite.

Sloan mine.—Gold; pyrite.

Beck's.—Pyrolusite; manganese garnet; psilomelane.

High Shoals.—One mile above, granular calcite.

Ellison ore bank.—Hematite; magnetite; chlorite; orthoclase; epidote; tourmaline.

Ormond ore bank.—Limonite, compact and fibrous; psilomelane, nickeliferous.

Mountain mine.—Hematite, mammillary and cellular; pyrolusite; quartz.

King's Mountain.—Gold; galenite; altaite; chalcopyrite; sphalerite; tetrahedrite; nagyagite; magnetite; bismite; calcite; dolomite; pyrrhotite; chalcopyrite; limonite; barite; pyrite; graphite; cassiterite.

Long Creek mine.—Nickeliferous psilomelane (!); gold; pyrite; fluorite; sphalerite; mispickel; galenite.

Duffie mine.—Gold; pyrite; chalcopyrite; also at B. Wells's mine.

Oliver mine.—Gold; silver; galenite.

White's mills.—Epidote; biotite; orthoclase (!); pycnite; titanite.

Wells's farm.—Magnetite; hematite; pyrite; rutile; garnet; zircon (?); beryl; tourmaline; monazite; asbestos; menaccanite; azurite; bor-nite (?).

Rhodes's mine.—Epidote; actinolite; gold.

Ferguson mine.—Magnetite; pyrite.

All-Healing Springs.—Barite.

Elsewhere.—Sulphur; pyrite; magnetite; calcite; siderite; gold in placers and veins, at the Dew, Smith, Farrar, Beattie, McLean, High Shoals, and Cannon mines.

GATES.

Calcite, in marl beds.

GRAHAM.

Gold; calcite, granular, white, and flesh-colored; talc; pyrite.

GRANVILLE.

Young's Cross Roads.—Gold; pyrite; two miles southeast, malachite.

Near Oxford.—Magnetite; limonite; epidote; hematite; gold; lignite on Tar River, near Crews's.

Patterson mine.—Native copper.

Grisson.—Enstatite.

Bowling's Mountain.—Radiated pyrophyllite.

Sassafras Fork.—Gold; pyrite; a few miles north, malachite; tourmaline; quartz crystals; agate.

Near Shiloh Church.—Epidote; labradorite; calcite.

Elsewhere.—Stibnite, in the northern part of the county, on land of N. A. Gregory.

GREENE.

Limonite; siderite; glauconite; calcite in marl.

GUILFORD.

Cambridge mine.—Chalcocite; pyrite (!); chalcopyrite; barnhardtite; chrysocolla; malachite.

Fisher Hill.—Gold; pyrite; chalcopyrite; magnetite; hematite; menaccanite; limonite; pseudomalachite; siderite.

Beard mine.—Gold.

Friendship.—Granular corundum (emery); titaniferous magnetite.

Gardner Hill.—Bornite (?); chalcopyrite; chrysocolla; malachite.

Greensboro.—Hornblende, at Polecat Creek; pyroxene; pyrite; five miles west, gold; pyrite; chlorite; nine miles south, kaolinite, and also six miles west.

High Point.—Graphite; talc; chalcopyrite; orthoclase.

McLeansville.—Asbestos (?) in green quartz.

Near Alamance Church.—Kaolinite.

McCulloh mine.—Copper; cuprite in acicular crystals (!); pyrite; chalcopyrite; siderite; malachite.

Near Jamestown.—Gold; pyrite; steatite.

North Carolina (Fentress) mine.—Cuprite in acicular crystals (!); pyrite; chalcopyrite; siderite; malachite.

Phoenix mine.—Chalcopyrite; covellite.

Elsewhere.—Gold in veins; meteoric iron; molybdenite; limonite; rock crystal; pyrite; manganese garnet; magnetite; asbestos in green quartz (!), (Humphrey's); titaniferous magnetite, with hematite and limonite, chlorite, in a double range of outcrops of 20 miles length across the northwest section of the county, from the head of Deep River, on the Forsyth line, to the Rockingham line, near the Piedmont railroad at Haw River; kaolin at C. S. Leonard's, in the southern part of the county.

HALIFAX.

Near Ransom's Bridge.—Gold in placers; pyrite.

Fishing Creek.—Magnetite crystals and cubical pyrite in slate.

Gaston.—Hematite, micaceous and granular; magnetite; chlorite; limonite; 6 miles south, Hines's place, hematite; magnetite.

Elsewhere.—Petrified wood; epidote; zircon and garnet, in gold gravels; calcite and glauconite in marl; apatite; epidote.

HARNETT.

Harrington.—Calcite, granular.

Near Buckhorn.—Hematite; rutile in quartz; epidote; prochlorite (?).

Northington's Dam.—Chrysocolla; calcite, in gneiss rock.

Little River.—Magnetite, several places.

Douglass ore bed.—Magnetite.

Chalk Level.—Limonite (bog ore).

Hector's Creek.—Smoky quartz.

Elsewhere.—Talc; magnetite; kaolin, abundant at Spout Springs and at several other places.

HAYWOOD.

Big Ridge mine.—Muscovite; biotite; tourmaline; apatite; menaccanite; albite; autunite; kaolin.

Waynesville.—Corundum; two miles above, talc; asbestos; tremolite; on Richland creek, 2 miles below, psilomelane; garnet; limonite; muscovite; cyanite; 4 miles south, menaccanite.

Hall's mine.—Chrysolite; corundum; talc; chlorite; tremolite.

Presley mine.—Corundum, blue and gray, altered into muscovite and albite; albite; muscovite in large crystals, also in scales cryptocrystalline and compact.

Wilkins's Creek.—Magnetite with limonite; chalcopyrite; pyrite.

Cove Creek.—Psilomelane; limonite.

Pigeon River, east fork.—Corundum; pyrrhotite; wad.

Pigeon River, west fork.—At Sorrell's mine, nickeliferous (?) pyrrhotite.

Upper Pigeon Valley.—Graphite.

Ground Hog Creek.—Galenite.

Jonathan's Creek.—Cyanite; pyrrhotite; graphite; garnet.

Ruce's mine.—Opalescent quartz; pyrite; garnet.

Springdale.—Melanterite; pyrite.

HENDERSON.

Coleman's Station.—Zircon; phlogopite; jefferisite.

Green River.—On south side of Blue Ridge, at Freeman's, zircon; xanthitane; calcite, granular; titaniferous garnet at Jones's mine; auelrite; on Price's farm, zircon; auelrite; on the Davis land, poly-crase; zircon; monazite; xenotime; cyrtolite; magnetite.

Elsewhere.—Beryl; limonite; hematite; vermiculite; meteoric iron.

HERTFORD.

Calcite, in marl beds.

HYDE—(None.)

IREDELL.

Belt's Bridge.—Pyrite in soapstone; corundum (!) in globular masses, partly altered into muscovite, etc.; near Belt's Bridge, limonite; Hendrick's farm, corundum in hexagonal crystals (!) partly altered into margarite; orthoclase; tourmaline; muscovite (!) soda-margarite at Hendrick's farm.

Center Point. At Beam's farm; limonite (!) pseudomorphous after nodular pyrite.

Crawford's farm.—Quartz pseudomorphous after calcite.

Damascus.—Menaccanite.

Dr. Halyburton's.—Leucopyrite (!); scorodite.

King's Mill.—Graphite (!); hematite in hexagonal plates in quartz; rutile (!), in quartz, at Mrs. Jordan's, Alex. Lackey's, Misses Bennett's, Thomas Adams's and Mrs. Smith's farms; rock crystal (!); quartz crystals inclosing liquid (!); chalcedony; tourmaline (!).

Mount Pisgah.—Rutilated quartz (!) at Mrs. Daniel's farm; chloritic mineral resembling thuringite.

Rocky Creek.—Graphite.

Spring Mountain.—Graphite (!).

Statesville.—Near Statesville, titanite in gneiss; quartz crystals; 6 miles north, allanite; 8 miles southeast, on road to Salisbury, tremolite; 2 miles west, corundum (!), rarely altered into cyanite (!); orthoclase (!) on Houp's farm; cyanite (!), 2 miles west and 6 miles southwest of Statesville on Hoover's farm, with muscovite (!); 4 miles distant, goethite in thin scales, in light red feldspar (sunstone); 5 miles west, on John Sumpter's farm, rutile; zircon; cyanite; transparent ripidolite. 7 miles north, on farm of G. W. Chipley, near South Yadkin River, gray corun-

dum in crystals. At Statesville rock quarry, sunstone; titanite; hornblende in large crystals.

Bethany Church.—Allanite, with small crystals of zircon; above Lock's Bridge, corundum altered into prochlorite and margarite.

Hunting Creek.—Albite; blue corundum altered into rhaetizite. On Sale's farm, near Campbell's Mill, large boulders of cyanite inclosing crystals of blue corundum.

Near Shiloh Church.—Red ocher.

Near Holland Springs.—Quartz crystals.

Davidson Township.—Quartz, inclosing transparent red goethite.

Rockwell.—Smoky quartz.

Elsewhere.—Marcasite; magnetite near Comb's, and on South Yadkin River.

JACKSON.

Casher's Valley.—Bismutite; talc; muscovite; amethyst; rock crystal; gold; pyrite; chalcopyrite.

Cullowhee mine.—Chalcocite; pyrite; melaconite; chalcopyrite (!); hornblende; malachite.

Hogback mine.—Corundum (!); rutile in corundum, rare; chromite; drusy quartz; chrysolite (!); andesite (!); tourmaline; muscovite (!); dudleyite; margarite (!).

Savannah mine.—Chalcopyrite; hornblende; tourmaline; malachite.

Horse Cove.—Muscovite; beryl.

Tennessee Creek.—Tremolite; grammatite; chlorite; actinolite; talc; asbestos; prochlorite (!).

Whiteside Mountain.—Garnet; orthoclase; tremolite; actinolite; chalcopyrite; magnetite; asbestos; muscovite; biotite; wad.

Balsam Mountain.—Tourmaline; pyrolusite; chalcopyrite.

Waryhut mine.—Chalcocite; chalcopyrite; cuprite; malachite.

Georgetown and Fairfield.—Gold in placers.

Webster.—Corundum; chromite; pyrolusite; wad; chalcedony; drusy quartz; enstatite (!); tremolite (!); actinolite (!); asbestos; chrysolite (!); talc (!); serpentine; marmolite; deweylite; genthite; penninite (!); magnesite (!), crystalline and earthy; magnetite; kaolin; kämmererite; 6 miles north, chrysolite and enstatite; 10 miles west, hornblende.

Wolf Creek mine.—Chalcocite; native copper; chrysocolla; chalcopyrite; malachite.

Ainslie's.—Chrysolite; chromite; talc; chlorite; enstatite; smaragdite (!); asbestos; tremolite; garnet; actinolite; albite.

Scott's Creek.—Chrysolite; chromite; talc; penninite (var. kämmererite); enstatite; chlorite; corundum (blue and pink).

Toxaway River.—Calcite, granular.

Elsewhere.—Gold in placers; psilomelane; calcite; asbestos; talc; limonite; muscovite in many mica mines; galenite; at Bryson's and in Hogback Valley, hematite; at Dr. Morgan's, psilomelane.

JOHNSTON.

Elevation.—Clay ironstone; pyrite.

Leechburg.—Limonite.

Near Clayton.—Chloritic talc slate; graphite; kaolin.

Near Princeton.—Epidote.

Near Smithfield.—Limonite in many places.

Elsewhere.—Fossil wood; kaolinite; magnetite; pyrite; tourmaline; graphite; epidote; muscovite; quartz crystals; hematite.

JONES.

Calcite, in marl beds; limonite.

LENOIR.

Calcite, in marl beds; glauconite, in green sand marl.

LINCOLN.

Lincolnton.—Calcite; 12 miles northwest, reticulated acicular rutile; halloysite; kaolinite; graphite; limonite, 7 miles northwest and 2 miles east; on land of S. W. Childs, arsenopyrite.

Brevard's Forge.—One and one-half miles from Vesuvius furnace, magnetite (!); manganese garnet; quartz crystals.

Cottage Home.—Diamond (!); gold; chalcopryrite.

Macpelah Church.—Manganese garnet; psilomelane; pyrite and chalcopryrite, 2 miles east.

Graham mine.—Chalcopryrite; gold.

McBee's.—Psilomelane.

Keener's quarry.—Chalcopryrite; bornite.

Iron station.—Vivianite.

Randleman's.—Quartz crystals; amethyst (!).

Stowe's quarry.—Calcite, granular and compact.

Elsewhere.—Gold in placers and veins; sulphur; graphite; hematite; magnetite; limonite; muscovite; kaolinite; epidote; pyrite; calcite, near Lincolnton (!); asbestos; chalcedony; garnet; psilomelane; talc; cuprite; cyanite, blue and red; galenite; graphite; limonite; menacanite; actinolite.

MACON.

Houston's mine.—Muscovite; corundum: talc; tremolite; chlorite; tourmaline.

Lyle's mine.—Muscovite; biotite; kaolinite.

J. Moore's.—Chromite; corundum.

Thorn Mountain mine.—Muscovite; biotite; manganese garnet; albite; uranochre (!); zippeite (!); beryl; pyrrhotite; chalcopryrite.

Culsagee mine or Corundum Hill.—Corundum (!) in beautiful varieties crystallized and massive, and frequently in part altered into other minerals; chromite (!); spinel (!) in crystals and granular; rutile (!), rare; diaspore (!), one specimen only known; drusy quartz (!) and quartz crystals; chalcedony; hyalite (!); enstatite (!); tremolite; arfvedsonite (!); chrysolite (!); andesite (!); oligoclase; tourmaline (!); talc; serpentine (!); deweylite (!); cerolite; genthite (!); culsageeite (!); lucasite; kerrite (!); maconite (!); penninite (!); prochlorite (!); willcoxite (!); margarite (!); anthophyllite; actinolite; magnetite.

Bryson's mines.—Muscovite (!); labradorite; almandite garnet; orthoclase; albite; biotite.

Near Franklin.—Sphalerite; chalcopyrite; menaccanite (!); wad; garnet (!); epidote (!); fibrolite (!); cyanite (!); staurolite (!); kaolinite (!); rhodochrosite; corundum; pyrite; 7 miles south, chromite, chlorite; 9 miles south, chrysolite; 11½ miles south, prochlorite; 14 miles south, corundum and talc in chrysolite.

Highlands.—Bismutite; beryl.

Haskett's.—Limestone quarry; magnetite; corundum (!), in part altered into muscovite; tourmaline; calcite; garnet; molybdenite.

Jacob's mine.—Corundum; asbestos; tremolite; chrysolite.

Sugartown Creek.—Chromite; tremolite; actinolite; asbestos; chrysolite; garnet; biotite; orthoclase; magnetite; hematite; 8 miles from Franklin, prochlorite; talc; asbestos.

Nantehaleh River.—Asbestos; talc (!); compact limestone (!); niter; at mouth of river, orthoclase.

Tennessee River, below Franklin.—Garnet; staurolite; cyanite; muscovite; columbite.

Tibbet's mine.—Pleonaste; zircon.

West's mine.—Ruby corundum with cyanite.

Gregory Hill.—Chrysolite; anthophyllite; bronzite; foliated talc; prochlorite; asbestos.

Hall mine.—Muscovite (!); biotite; granular quartz; orthoclase; garnet; albite.

Rocky Face.—Garnet; muscovite; biotite.

Jarrett's.—Steatite; chalcedony; fibrous talc.

Potato Knob mine.—Muscovite; biotite.

West's Mills.—Psilomelane.

Ellijay Creek.—Near Higdon's: corundum; chlorite; asbestos; chromite; magnetite; hematite; garnet; chrysolite. At Goshen, calcite, granular; coccolite; graphite; spessartite.

Highlands.—Gold; rose quartz.

Catoogajay Creek.—Magnetite, at Sloan's.

Elsewhere.—Graphite; garnet; chalcopyrite; magnetite; hornblende, 23 miles below Franklin; beryl; rose quartz; magnetite; muscovite and biotite in numerous mica mines; gold and galenite in Cowee Mountains.

MADISON.

Bear Creek.—Magnetite (!), 2 miles from mouth; green coccolite, in granular calcite; chlorite; epidote; cyanite; staurolite; talc; garnet, (large crystals); 1 mile from mouth, tremolite; hornblende; 1½ miles from mouth, chrysolite; magnetite.

Mars Hill.—Monazite; zircon.

Big Laurel.—Magnetite (!); menaccanite (!); milky quartz; pyrite; calcite, granular, and massive.

Carter's mine.—Corundum (!) in peculiar white and pink varieties; spinel (!); chromite; hornstone; drusy quartz; tremolite; chrysolite (!); andesite (!); prochlorite (!); culsageeite; menaccanite; beryl (!).

French Broad River.—Orthoclase; calcite, with coccolite; limonite, in a heavy bed, near State line.

Duel or Jewell Hill.—Meteoric iron (!); ferrous chloride in meteorite; hematite.

Near Marshall.—Calcite; pyrite; rutile; limonite; magnetite (!); gale-nite; bornite; chalcopryrite; epidote; talc; fluorite; hematite, near Gudger's, 9 miles below Marshall; corundum (!), 3 miles below Marshall; diasporé (?); prochlorite (!); margarite; barite, at Chandler's, 9 miles below Marshall; 4 miles west of Marshall, smoky quartz, in doubly terminated crystals; 1 mile below Marshall, agate; hornblende; 3 miles below, augite (?); 6 miles below, penninite; orthoclase; 8 miles below, epidote; orthoclase; 9½ miles below, penninite; orthoclase; 4 miles up Ivy Creek, hornblende.

Walnut Creek, near French Broad River.—Green coccolite, in calcite; phlogopite.

Hot Springs.—Cryptocrystalline muscovite (!); calcite; red jasper; pyrite; psilomelane; gold, in veins and placers; garnet.

Shut In Creek.—Calcite; jasper.

Spring Creek.—Magnetite, in large bed, massive.

Ivy River, two miles from mouth.—Smith mine: magnetite; pyroxene. At Radford's, hematite and magnetite.

Brush Creek.—Magnetite, at Freeman's and Sikes's; coccolite in calcite; barite.

Paint Creek.—Pyrrhotite.

Haynie mine.—Blue corundum; rutile; margarite; green crystals of hornblende; magnetite; chlorite; menaccanite.

MARTIN.

Calcite, in marl beds.

M'DOWELL.

Cave of Tantalus.—Stalactitic calcite.

Humpback Cave.—Stalactitic calcite.

Cedar Cove, at Dodson's mine.—Sphalerite; calcite, granular and compact.

Kirksey's mine.—Tetradymite.

Linville Mountains.—Itacolumite; radiated pyrophyllite; limonite, in many places; hematite; calcite, granular and compact, several places; meteoric iron.

Peter's Cove.—Stalactitic calcite; magnetite; limonite.

Turkey Cove.—Calcite, granular and compact.

Turkey Creek.—Bee Rock: epidote (!); tourmaline.

In the gold placers.—Gold; corundum; menaccanite; rutile; chromite; brookite; pyrope; zircon (!); epidote; fibrolite; xenotime (!); monazite (!); diamond; anatase.

Marion.—Within a few miles, limonite; manganese garnet; psilomelane; calcite.

Raccoon Cave.—Stalactitic aragonite.

Round Knob.—Cyanite; garnet; paragonite.

Graveyard Mountain.—Hematite; limonite; calcite.

Head of Tom's Creek.—Magnetite; muscovite; kaolinite.

Elsewhere.—Limonite; calcite; samarskite; dolomite, one-half mile east of Yancey's mine.

MECKLENBURG.

Beattie's Ford.—Rutile (!) in acicular crystals.

Capp's Hill.—Magnetite; gold; pyrite; chalcopyrite.

Charlotte.—Orthoclase var. leopardite (!); at the Rudisill mine, gold-bearing pyrite; chalcopyrite; white siderite; 2 miles from Charlotte, pyrite; chalcopyrite; magnetite, fine granular; at new cemetery, epidote.

Davidson College.—Radiated cyanite; pyrophyllite; gold; agate, 5 miles south at D. Caldwell's; hematite at Gibson's, 5 miles from Davidson College; 7 miles south, fine crystals of rutile; 12 miles southwest, granular hematite.

Hopewell mine.—Chalcopyrite; chrysocolla; pyrite; gold.

McGinn mine.—Gold; pyrite; chalcopyrite; barnhardtite; cuprite in acicular crystals; melaconite; pseudomalachite (!).

Old Harris mine.—Hematite; menaccanite.

Providence.—Twelve miles south of Charlotte, chalcopyrite; gold; pyrite; magnetite.

Todd's Branch.—Gold; diamond (!); zircon (!); garnet; monazite (!).

Tuckasegee Ford.—Epidote; labradorite near Tuckasegee Ford.

Stephen Wilson's mine.—Gold; pyrite; chalcopyrite; siderite.

Gibson mine.—Gold; also at Jordan mine, Brown mine, Carson mine, Icyhour mine, Burnett mine, Neal mine, Brawley's mine.

Roswell mine.—Gold; pyrite; also at Stearne's mine, Roger's mine, Stinson mine, Crosby mine, Johnson mine, Juggernaut mine, Frazer mine, Taylor mine, Maxwell mine, Nolen mine, Crump mine, Bane mine, McCorcle mine, Hunter mine, Henderson mine, Alexander mine, J. Alexander's mine, Caldwell mine, Davidson and Blake mine.

Sugar Creek.—Magnetite.

Faire's mine.—Gold; pyrite chalcopyrite.

Frederick mine.—Gold; pyrite; chalcopyrite; chrysocolla; malachite.

Maxwell mine.—Gold; pyrite; chalcopyrite; also at Clark's mine, Ray mine, Hipp mine, Trotter mine, Harris mine, Henderson mine, Kern mine, Cathey mine, G. C. Cathey's mine, Sloan mine, McLean mine, Charlotte mine, and Queen mine.

Steele Creek.—Pyrolusite.

Elsewhere.—Gold, in placers and veins; copper in quartz crystals; sulphur; magnetite, near Steele Creek Church; foliated hematite at Sol. Reid's; tourmaline.

MITCHELL.

Bailey mine.—Orthoclase; hyalite.

Toe River Ford.—Actinolite, large crystals in talc; muscovite.

Bakersville.—Muscovite; chalcopyrite; pyrite; $2\frac{1}{2}$ miles south, pyrophyllite; chromite(!); saponite; quartz crystals; chalcedony(!); enstatite(!); tremolite; actinolite; chrysolite(!); talc; rutile, penetrating corundum; serpentine; deweylite; penninite(!); magnesite; $1\frac{1}{2}$ miles southeast, asbestos; talc; limonite; corundum; 2 miles southeast, limonite; psilomelane; $3\frac{1}{2}$ miles north, apatite; at Hawk mine, oligoclase(!); on Yellow Mountains, cyanite(!).

Blalock's.—Garnet; muscovite(!); orthoclase(!); kaolinite; columbite.

Buchanan mine.—Gummite; yttrogummite(?); asbestos; beryl; allanite(!); muscovite(!); albite(!); phosphuranylite(!); cyanite; graphite; manganese garnet; black garnet; magnetite; limonite; apatite; orthoclase.

Cane Creek.—Menaccanite(!); actinolite; talc; asbestos; near head, graphite; rutile; garnet; samarskite.

Crab Orchard.—Menaccanite(!).

Autrey's.—On Brush Creek: quartz crystals, smoky; black garnet; kaolinite.

Cranberry.—Magnetite(!); pyroxene; epidote; picrolite; 1 mile west, hematite; orthoclase.

Plum Tree Creek.—Corundum crystals; hyalite.

Roan Mountain.—Hornblende.

Near White Plains.—Gummite with uraninite in a mica mine.

Deake mine.—Quartz, flattened out between muscovite; muscovite(!); columbite(!); gummite; albite; gahnite; monazite.

Flat Rock.—Menaccanite(!); uraninite(!); gummite(!); zircon; garnet; epidote; zoisite, var. thulite(!); muscovite(!); pink muscovite(!); albite(!); orthoclase(!); uranotil(!); phosphuranylite(!); autunite(!).

Grassy Creek.—Samarskite; menaccanite; kaolinite; beryl, large muscovite; autunite; hyalite; columbite.

Point Pizzle.—Albite(!); apatite(!); pyrophyllite; actinolite; beryl—~~garnet~~; manganese garnet; muscovite.

Old Fields of Toe.—Miller's Gap: epidote; talc; chlorite.

Unaka Mountains.—Magnetite (!); zircon (!); epidote; hematite.

Wiseman mine.—Muscovite (!); kaolinite; hatchettolite (!); columbite (!); samarskite (!); altered samarskite; rogersite; epidote; garnet.

Gillespie Gap.—Psilomelane; monazite; epidote; chalcopyrite; one-half mile west, prochlorite; psilomelane.

Burnsville.—Six, 13, and 14 miles north, labradorite in trap; 14½ miles north, prochlorite; calsageeite (?); asbestos; actinolite; tremolite.

Pumpkin Patch Mountain.—Magnetite; labradorite; garnets.

Burlison's.—Asbestos; actinolite; talc.

Lick Ridge mine—Muscovite; albite; garnet, red and black; biotite; pyrite; chalcopyrite; hyalite.

Cox mine.—Smoky quartz; manganese garnet; albite; autunite; muscovite; biotite; apatite; labradorite; pyrite; orthoclase (?).

Eagle Mine.—Kyanite; muscovite; orthoclase; albite.

Gibbs's Mine.—Muscovite.

North Toe River.—Orthoclase; muscovite; chrysolite; talc; chrysotile; asbestos; prochlorite; wad; garnet; serpentine; 2½ miles north-east, kaolin; chalcedony.

Young's.—On South Toe River; serpentine; garnet; talc; chrysolite; prochlorite; tremolite; pyrite.

Elsewhere.—Galenite (!); rutile; garnet; epidote; fergusonite; actinolite (S. Blalock's); rock crystal; muscovite; kaolinite in numerous mica mines; corundum, 1 mile from Stewart's.

MONTGOMERY.

Cheek's Creek.—Fossil wood.

Cottonstone Mountain.—Pyrophyllite (!!)

Crump Mine.—Gold (!) in placers.

Christian mine.—Same as Swift Island.

Steele mine.—Gold (!!); galenite; sphalerite; chalcopyrite; albite; prochlorite; calcite.

Burnett Mountain.—Gold in placers.

Swift Island mine.—Gold (!!) in fine crystals.

Beaver Dam mine.—Gold in placers.

Elsewhere.—Gold in viens and placers; argentite in slates; magnetite; 5 miles above mouth of Uwharrie River, hematite; ferruginous quartz.

MOORE.

Carthage.—Twelve miles east: hematite.

Cheek mine.—Chalcopyrite; malachite; azurite; galenite; red jasper; epidote; talc; calcite; argentite; pyroxene; limonite.

Jonesboro.—Two miles south, on Cane Creek; malachite.

Swan's Station.—Kaolin.

Sanford.—Pyrite; gold.

Johnson's mills.—Tourmaline; acicular hornblende in quantity.

Soapstone Quarry.—Slaty pyrophyllite (!); pseudomalachite.

Upper Little River.—Cyanite.

Welch's.—Chrysocolla; chlorite.

Elsewhere.—Gold in veins and placers; pyrite; fossil wood; at E. Kelly's, limonite; magnetite; enstatite; wad; at P. Martin's, agate; at J. Dunlap's, quartz crystals; at Johnson's mill.

NASH.

Battleboro'.—Kaolin.

Tom Arrington mine.—Gold in placers.

Mann mine.—Gold in placers; psilomelane.

Elsewhere.—Gold in placers; meteoric stone, near Castalia; crocoite (!); hematite; limonite; calcite, in placers; in Stony Creek township, chalcedony.

NEW HANOVER.

Calcite (!), granular and crystalline; lignite; glauconite; limonite; phosphatic nodules (!) in limestone at Castle Hayne.

NORTHAMPTON.

Calcite, in marl beds.

ONslow.

Calcite and phosphatic nodules (!) in marl.

ORANGE.

Aaron's Creek.—Jaspery quartz; radiated pyrophyllite (!).

Chapel Hill.—Hematite (!); limonite; epidote; near Chapel Hill, chalcopryite; pyrite; magnetite; serpentine; hematite, pseudomorphous after pyrite; 4 miles west, limonite after pyrite; 7 miles west; pyrophyllite.

Hillsboro.—Pyrite in cubes; wad; limonite; hematite; pyrophyllite (!); chlorite in fine scales; epidote; barite (!), at Latta mine; braunite (!); hematite, 6 miles south; pyrite; chalcopryite; 5 miles southeast, magnetite.

Eno River.—Serpentine; steatite.

University Junction.—Hornblende; hematite.

Elsewhere.—Halite in brine; micaceous hematite at Flat River and Elleby Creek; epidote; hematite, pseudomorphous after pyrite; serpentine; moss agate, slaty pyrophyllite.

PAMLICO.

Calcite, in marl beds.

PASQUOTANK—(None).

PENDER.

Calcite; glauconite; limonite; phosphatic beds; at Rocky Point, phosphatic nodules in limestone.

PERQUIMANS—(None).

PERSON.

Mount Tirzah.—Hematite, micaceous; menaccanite.

Barnett Mountain.—White cyanite (!).

Dillahay's mine.—Gold; radiated quartz.

Gillis mine.—Chalcocite; pyrite; covellite; micaceous hematite; chrysocolla; cuprite; malachite; calcite; garnet; quartz; epidote.

Leasburg.—Tourmaline; 3 miles north, albite (?).

Hico.—Felsite; graphite.

Roxboro.—Epidote in granite.

Mill Creek.—Chalcocite; chrysocolla.

Harris's mine.—Copper in epidote.

Woodsdale.—Gold in vein; pyrite.

Elsewhere.—Graphite, on Cane Creek; limonite; steatite; talc; hematite; magnetite; on W. A. Gillis's farm, chrysolite.

PITT.

Calcite; glauconite; siderite; limonite, in beds near Tranter's Creek; succinite.

POLK.

Sandy Plains.—At Davis's mine: gold; limonite; pyrite. At Morris's mine: gold; monazite; pyrite; epidote; asbestos; tourmaline. At Prince mine: monazite; rutile; zircon.

Morrill Mills's gold mine.—Euclase (?).

Hungary River.—Gold, in placers.

Pacolet River.—Gold, in placers.

Tryon Station.—Garnet; tourmaline.

Tryon Mountain.—Asbestos.

Elsewhere.—Gold in placers; monazite; xenotime; rutile; epidote; quartz crystals; manganese garnet; turgite.

RANDOLPH.

Near Ashboro.—Pyrophyllite.

Franklinsville.—Five to 7 miles west-northwest, leucopyrite.

Pilot Knob.—Pyrophyllite (!); gold, in placers; acicular rutile in quartz.

Hoover Hill mine.—Gold; galenite; calcite.

Kinley mine.—Gold; pyrite.

Jones mine.—Gold; pyrite; limonite.

Parish mine.—Gold; talc; tremolite; actinolite.

Elsewhere.—Gold in veins and placers; meteoric iron (!); magnetite; siderite; hematite (micaceous).

RICHMOND.

Rockingham.—Eight miles southeast: kaolin.

Hitchcock Creek.—Orthoclase (!); oligoclase.

Hamlet.—Kaolinite.

Elsewhere.—Pyrophyllite, in quartz schists; chlorite; on Yadkin River, 7 miles above mouth of Little River, calcite and shell limestone.

ROBESON.

Calcite, in marl beds; near Maxton, kaolin.

ROCKINGHAM.

Madison.—Chalcopyrite at W. Lindsay's; manganese garnet.

Leaksville.—Semi-bituminous coal.

Meadows.—Bog iron ore.

Smith's River.—Two miles east of Morehead's factory: hematite; gold; asbestos.

Troublesome Creek.—Magnetite; hematite; limonite.

Smith's Mountain.—Meteoric iron (!!) with schreibersite and ferrous chloride. Also on Deep Spring farm.

Reidsville.—Muscovite; near Reidsville, halloysite; 6 miles north, magnetite.

Wentworth.—Asbestos; near Wentworth, tourmaline; one-half mile south, pyroxene and tourmaline.

Elsewhere.—Halite in brine; titaniferous magnetite (!); garnet; cyanite; on Dan River, 4 miles above Town Fork, hornblende.

ROWAN.

Gold Hill.—Gold (!); bismuthinite; pyrite; chalcopyrite; arsenopyrite (!) at Honeycutt's; magnetite.

Salisbury.—Orthoclase (!); 7 miles south, Gold Hill road, pyrite; chalcopyrite; chrysocolla; talc.

Yadkin mine.—Gold; pyrite.

Dunn Mountain mine.—Gold; pyrite; chlorite.

Snider mine.—Gold; pyrite.

Grupy mine.—Chalcopyrite; pyrite; chrysocolla.

Cope mine.—Gold; also at Haynes mine, Cady mine, Bringle mine, Trexler mine, Yadkin mine, Bane mine, Roseman mine, Earnhardt mine, Holtshauser mine, in veins and placers.

Rhymer mine.—Gold; pyrite; hematite.

Elsewhere.—Orthoclase, in large and twin crystals; gold; pyrite.

RUTHERFORD.

Brindletown Creek.—Diamond (!).

Jeanstown.—Platinum; palladium (?); at Weaver's, garnet; epidote; tourmaline; gold; manganese garnet.

Laurel Springs.—Garnets.

Rutherfordton.—Quartz, pseudomorphous after calcite (!).

Shemwell mine.—Arborescent gold (!).

Second Broad River.—Head of it, gold in veins and placers; pyrite.

Twitty's mine.—Diamond (!).

At the gold placers generally.—Gold; corundum in grains and crystals; menaccanite; rutile; chromite; brookite; rock crystal; garnet; zircon (!); epidote; samarskite; fergusonite; xenotime (!); monazite; wolframite (?).

Elsewhere.—Amethyst; melanterite; alunogen; fergusonite; anatase; corundum; fibrolite; tourmaline; gold; pyrite; meteoric iron.

SAMPSON.

Calcite in marl beds; lignite.

STANLEY.

Hearne mine.—Gold; pyrite; chalcopyrite; calcite; chlorite; serpentine.

Crowell mine.—Gold.

Elsewhere.—Gold in veins and placers.

STOKES.

Bolejack's quarry.—Calcite (!); phlogopite; actinolite.

Coffee Gap.—Lazulite (!) with muscovite in quartz.

Danbury.—Magnetite (!); pyrolusite; cyanite; actinolite; at Roger's ore bank, titanite; sulphur (!) in a limonite quartz geode; asbestos; hornblende; pyrite in muscovite; 7 miles east of Danbury, hornblende.

Dan River.—Opalescent quartz; anthracite and bituminous coal; prochlorite; hematite; magnetite.

Germanton.—Fossil wood (!); 2 miles east, serpentine; calcite; garnet.

Moore's Mill.—Manganese garnet.

Peter's Creek.—Sulphur (!).

Sauratown Mountain.—Itacolumite (!); asbestos.

Snow Creek.—Hematite, at Martin's quarry; chalcedony; hornstone; phlogopite; granular calcite; agate; amethyst; hyalite; jasper; hematite; albite; 6 miles east, pyrolusite.

Stokesburg.—Rock crystal; anthracite and bituminous coal.

Elsewhere.—Copper; graphite; chalcopyrite; muscovite in pyrite; gold in pyrite; siderite; tourmaline; talc; muscovite (large plates); epidote; limonite; calcite, granular, on Little Yadkin and Dan Rivers.

SURRY.

Dobson.—Ten miles north, manganese garnet; pyrolusite; talc in green crystals; serpentine: steatite; actinolite; breunnerite; magnetite; chlorite; hausmannite (?); wad; near Dobson, magnetite in prochlorite.

Ararat River.—Four miles southeast of Mount Airy, pyrite (!); magnetite (!); garnet; white cyanite (!).

Chestnut Mountain.—Octahedral magnetite (!).

Fisher's Peak.—Octahedral magnetite.

Pilot Mountain.—Talc (!).

Tom's Creek.—Magnetite.

Rockford.—Steatite.

War Hill.—Milky quartz.

Williams's mine.—Magnetite.

Elkin.—Barite; galenite; pyrite; chalcopyrite; 2 miles east, chalcopyrite; 10 miles north, limonite; hematite; 5 miles northeast, pyrite; chalcopyrite; chrysocolla.

Elsewhere.—Graphite; tourmaline; garnets; magnetite; limonite; chalcopyrite; sulphur; galenite; pyrrhotite; pyrite; psilomelane; asbestos.

SWAIN.

Bryson City.—Rutile; zoisite; limonite after pyrite.

Oconaluftee River.—Gold; galenite, argentiferous; pyrite; chalcopyrite.

A. Nichols's.—Pyrolusite; chalcocite; tourmaline.

Quallatown.—Gold, in placers.

Elsewhere.—Itacolumite; magnetite; hematite; limonite; talc.

TRANSYLVANIA.

Boyston River.—Gold, in placers; granular calcite; limonite.

Davidson River.—Chalcopyrite; pyrite; flinty quartz.

Mills's River.—Calcite.

Brevard.—Chlorite; graphite; limonite after pyrite; kaolin.

Elsewhere.—Pyrite; chalcopyrite; rose quartz; pyrrhotite; tourmaline; graphite; near mouth of Looking-glass Creek, kaolin.

TYRRELL—(None.)

UNION.

Lemmond mine.—Gold (!); electrum (!); galenite; sphalerite; pyrite; arsenopyrite; pyromorphite.

Long mine.—Gold; galenite.

Moore's mine.—Gold; sphalerite; pyrite; chalcopyrite; galenite.

Pewter mine.—Electrum.

Phifer mine.—Gold; silver; galenite; also at Lewis mine and Wash-ton mine.

Stewart mine.—Gold (!); electrum (!); galenite; sphalerite; pyrite; arsenopyrite; pyromorphite.

Union mine.—Gold; also at Davis mine, Dulin mine, Fox Hill mine, Crump mine, Cureton mine.

Walkup's mine.—Barite (!), granular.

Smart mine.—Gold; pyrite; chalcopyrite; galenite; sphalerite.

Elsewhere.—Gold, in veins and placers.

VANCE.

Near Henderson.—Pyrite; chalcopyrite; talc; calcite.

Kittrell's.—Chalcedony.

WAKE.

Forestville.—Seven miles west, magnetite; menaccanite; prochlorite.

Barton Creek.—Pyrite, large cubes; hematite, pseudomorphous after pyrite; tourmaline; chlorite.

Brassfields.—Calcite; chalcedony.

Witherspoon's.—Granular calcite.

Wyatt's.—Limonite.

Cary.—Pyrite; hematite; martite; sulphur.

Northwest corner of county.—Serpentine; asbestos; actinolite; stea-tite; cyanite.

Soapstone Church.—Talc; asbestos; serpentine.

Morrisville.—Granular calcite.

Raleigh.—Menaccanite (!); epidote; hematite; magnetite; chryso-lite (?); malachite in granite; muscovite; paragonite (?); near Raleigh, pyrite; chalcopyrite; graphite; smoky quartz; garnet; biotite; 3 miles west, orthoclase; 4 miles northwest, amethyst; $4\frac{1}{2}$ miles west, pyrite; chalcopyrite; psilomelane; 8 miles west, pyrite and limonite after pyrite.

Elsewhere.—Graphite (!), at Tucker's Mill; pyrite; magnetite; ame-thyst; tourmaline; calcite; at mill on Clifton's Branch, vermicular quartz; in Little River Township, halloysite.

WARREN.

Middleburg.—Micaceous hematite; quartz crystals.

Warrenton.—Eight miles south, limonite after pyrite; 9 miles south, asbestos.

Ransom's Bridge.—Gold; garnet.

Elsewhere.—Quartz crystals; magnetite; epidote; gold, in placers; garnets.

WASHINGTON.

Calcite, in marl beds.

Bull. 74—8

WATAUGA.

Beech Mountain.—Fine-grained galenite (!); pyrite; magnetite; hematite; at Pogie, galenite.

Cooke's Gap.—Arsenopyrite; hematite (!); magnetite (!); itacolumite (!); limonite; martite.

Cove Creek.—Magnetite; limonite.

Rich Mountain.—Head of Cove Creek; chromite; quartz crystals; actinolite; chrysolite; epidote; penninite; tremolite.

Beaver Dam Creek.—Magnetite.

Elk Knob.—Pyrite; chalcopyrite; pyrrhotite; epidote; limonite; garnet.

Flannery mine.—Argentiferous galenite.

Miller mine.—Pyrite; chalcopyrite; limonite; epidote; chrysolite.

Watauga River.—Calcite; epidote; chlorite.

Elk River.—Jasper; epidote; chlorite; calcite; at L. Banner's, prochlorite; pyrite; quartz.

Hardin mine.—Gold, in placers.

Boone Fork.—Quartz crystals (fine).

Near Boone.—Actinolite; cyanite.

Elsewhere.—Gold in placers; galenite; fluorite; epidote; limonite; magnetite; cyanite; talc; chromite; chlorite; menaccanite; asbestos.

WAYNE.

Fossil wood; lignite; pyrite; calcite, in marl beds.

WILKES.

Wilkesboro.—Two miles north, serpentine; talc; garnet.

Mulberry River.—Magnetite.

Blue Ridge.—Three miles south, on road to Jefferson, garnet; orthoclase; apatite.

Bending Rock Mountain.—Itacolumite.

Brushy Mountains.—Asbestos.

Roaring River.—Magnetite.

Elk Creek.—Galenite; cerussite.

Flint Knob.—Galenite (argentiferous); pyrite.

Elkin Creek.—Barite; limonite; galenite; cerussite.

Honey Creek.—Rutile (!) in acicular crystals in brownish amethyst

Stony Hill.—Chalcopyrite; muscovite.

Trap Hill mine.—Galenite; pyrrhotite; chalcopyrite (auriferous); pyrite; rutile; garnet; tourmaline; magnetite.

Reddie's River.—Serpentine.

Elsewhere.—Graphite; corundum (!), mostly altered into cyanite; pyrite; cyanite (!); mixture of muscovite, margarite, etc., resulting from the alteration of cyanite.

WILSON.

Contentnea Creek.—Orthoclase; biotite.

Stantonsburg.—Pyrite.

Turkey Creek.—Amethystine quartz.

Elsewhere.—Calcite in marl beds; limonite.

YADKIN.

Near Yadkinville.—Gold.

Boyden's quarry.—Calcite, compact and granular.

Campbell mine.—Magnetite.

Hobson's mine.—Magnetite; tremolite; magnetite (!) at East Bend and elsewhere.

Near Forks of Yadkin River.—Calcite.

Jonesville.—Pyrite in cubes in slate; chalcopyrite.

YANCEY.

Grassy Knob (Black Mountains).—Cyanite; muscovite.

Black Mountain.—Graphite.

Bald Mountain.—Grayish green actinolite; magnetite.

Burnsville.—Platinum (!); labradorite (!) 6 miles north of Burnsville; tourmaline at Parrot's Ford, 3 miles from Burnsville; tantalite (!); 4 miles north of Burnsville, chromite and talc; 1 mile west, kaolin; 3½ miles west, margarite.

Hampton's, Mining Creek.—Chromite (!); chalcedony; enstatite; tremolite (!); actinolite; asbestos; chrysolite (!); orthoclase; talc (!); serpentine; deweylite; penninite; magnesite; epidote, in fine green crystals; bronzite; hornblende; prochlorite (?).

Hurricane Mountain.—Cyanite (!); titanite; muscovite.

Bald Creek.—Chrysolite; talc; asbestos; serpentine; tremolite; chlorite; pyrite; actinolite; epidote.

Ivy River.—Menaccanite.

Ray's mica mine.—Fluorite (!); pseudomorphous after apatite; yttrocerite (!); beryl (!); garnet; zircon; rutile; muscovite (!), also a scaly pink variety; orthoclase; tourmaline (!), black and yellowish green; kaolinite; columbite; apatite; monazite, very rare; autunite; amazon stone; cyanite; albite; smoky quartz; quartz crystals; actinolite; talc; glassy feldspar.

Mitchell's Peak.—Cyanite; fibrolite; garnet; biotite; tourmaline.

South Toe River.—Uranochre (?); muscovite; garnet; hyalite; gumite; autunite; garnet.

Proffit's.—Corundum; muscovite; asbestos; garnet; penninite (?); talc; near Proffit's, chrysotile; fibrous talc.

Young's mine.—Enstatite; chlorite; serpentine; chrysolite; chromite; talc; asbestos; tremolite; pyrite; manganese garnet, and garnet crystals; bronzite; tourmaline; muscovite.

Westall mine.—Cyanite.

Presnell (Young's) mine.—Muscovite; albite; apatite; autunite.

Gibb's mine.—Muscovite; albite; garnet; glassy feldspar.

Guggenheim's mine.—Muscovite; albite; manganese garnet; apatite; hyalite; tourmaline; autunite.

Rocky Creek.—Muscovite; pyrite; graphite.

Elsewhere.—Graphite; allanite; cyanite; columbite; magnetite; on Crabtree Creek, massive reddish garnet; rutile; muscovite; in many mica mines, pyrite.

INDEX.

A.		Page.		Page.
analysis by	61	Cerussite	84	
.....	27	Chalcanthite	81	
.....	56	Chalcocite	24	
.....	50-51	Chalcopyrite	25	
analyses by	62, 72, 73	Chatard, T. M., analyses by	45, 47,	
.....	23	.....	53, 54, 55, 65, 66, 67, 69	
.....	82	Chester, A. H., analysis by	85	
.....	85	Chlorite	67, 68	
.....	44-45	Chloritoid	68	
.....	37	Chromite	24	
.....	55	Chrysocolla	60, 61	
.....	81	Chrysolite	47	
.....	85	Clark, —, analysis by	16	
.....	20	Clarke, F. W. analyses by	54, 55, 64	
.....	76	Clingman, —, specimens furnished by	14	
.....	45	Coal, anthracite	85	
.....	23	bituminous	85	
.....	26	brown	85	
.....	15	Columbite	72	
.....	70	Comstock, W. J., analysis by	72	
.....	79	Cooke, J. P., jr., analysis by	65	
.....	84	Copper	14	
		Corundum	29-31	
		Cosalite, cupreous	27	
		Covellite	27	
		Crocidolite	46	
		Crocoite	81	
		Culsageeite	65	
		Cupreous cosalite	27	
		Cuprite	28	
		Cuproscheelite	80	
		Cyanite	58-59	
B.		D.		
.....	81	Dabney, analyses by	35	
.....	25	Deweylite	63	
S. de, analyses by	27, 33, 35	Diamond	21	
.....	46	Diaspore	38	
.....	52	Dolomite	83	
.....	40	Dudleyite	69	
.....	22	Duel Hill meteorite	16	
.....	84-85	Dufrenite	79	
active copper associated with		E.		
observed by	14	Eakins, L. G., analyses by	18, 71	
in meteorite	15	Edisonite	37	
.....	23	Enstatite	42	
.....	38	Epidote	50	
.....	37	Euclase	59	
analysis by	59			
analysis of meteorite by	16			
C.				
.....	61			
.....	82-83			
.....	35			
.....	28			
.....	63			

F.		M.	
	Page.		Page
Fergusonite	74-75	Mackintosh, J. B., analyses by	19, 71, 75
Ferrosilicene	20	Maconite	66
Ferrous chloride	28	Magnesite	83
Fibrolite	58	Magnetite	33
Fluorite	28	Malachite	84
Froebel, Chas., analysis by	26	Mallet, J. W., analyses by	51, 75
G.		Marcasite	26
Gahnite	33	Margarite	60
Garnet	48	Melaconite	29
Genthite	63	Melanterite	81
Glauconite	62	Menaccanite	31
Goethite	38	Meteorites	15-29
Gold	13	Microilite	71
Goslarite	81	Mispickel	26
Graphite	22	Misy	83
Gummite	38, 70	Molybdenite	26
H.		Molybdlite	46
Halite	28	Monazite	77-78
Halloysite	64	Montanite	83
Hanna, G. B., acknowledgments to	11	Muscovite	53-53
Hatchettolite	72	N.	
Hausmannite (?)	38	Nagyagite	26
Hematite	31	Niter	79
Hidden, William Earl, acknowledgments to	11	O.	
Meteorite described by	18	Oligoclase	55
Cited on rutile from Alexander County	36-37	Olivenite	78
Cited on quartz from Iredell County	41	Opal	43
Hillebrand, W. F., analysis by	36	Orthoclase	56-57
Hisingerite (?)	64	P.	
Holmes, J. A., acknowledgments to	11	Page, W. F., native iron found by	14
Humphreys, J. T., acknowledgments to	11	Palladium (?)	14
Hunt, T. S., analyses by	73, 74	Paragonite	64
Hunter, C. L., acknowledgments to	11	Penfield, analyses by	45, 77
I.		Penninite	66
Iron	14-20	Pharmacosiderite	79
J.		Phlogopite	53
Jarden, W. H., analyses by	54	Phosphuranylite	79
Julian, Frank, analyses by	43, 69	Pinite	64
K.		Platinum	14
Kaolinite	63	Polycrase	75
Keller, H. F., analysis by	51	Popplein, Geo. J., analysis by	56
Keller, H. M., analysis by	55	Prochlorite	67, 68
Keyser, P., analysis by	25-26	Proustite	27
Koenig, G. A., analyses by	33, 48, 53, 54, 65, 68	Pseudomalachite	78
Kokscharowite	45	Psilomelane	39
Kunz, G. F., acknowledgments to	11	Pyrite	24
Kunz, G. F., meteorites described by	17, 20	Pyrochlore	71
L.		Pyrolusite	3
Labradorite	54	Pyromorphite	7
Lazulite	78	Pyrophyllite	6
Lead	20	Pyroxene	4
Leucopyrite	26	Pyrrhotite	1
Lewis, Mary T., analyses by	53-54, 57	Q.	
Lignite	85	Quartz	
Limonite	38	R.	
Lucasite	66	Rhabdite	
		Rhodochrosite	
		Richards, Mrs. R. H., analysis by	

	Page.		Page.
L. B., analysis by	58	Taylor, W. J., analyses by	25-26
ite	75	Tetradymite	22
ordite	74	Tetrahedrite	27
.....	36	Thorite	70
		Titanite	60
S.		Topaz	59
imon)	28	Tourmaline	57-58
ite	73	Troilite	24
.....	64	Tungstate of lime	80
.....	80	Tyson, Samuel L., analysis by	62
r, E. A., analyses by	63, 65		
rsite	24	U.	
.....	79	Uraninite	35
M. H., analysis by	74	Uranotil	70
ntite	40		
ne	62-63	V.	
te	24	Venable, F. P., analyses of meteorites by ...	17, 18
.....	32, 33	Vesuvianite	49
ne	43	Vivianite	78
e	60		
on, J. A. D., acknowledgments to	11	W.	
on, J. A. D., furnishes specimens	72	Wad	39
or analysis	22	Wavellite	79
elane	62	Wikel, W. D., analysis of meteorite by	17
.....	80	Whitfield, J. E., analysis of meteorite by ...	17
.....	85	Willcoxite	68
C. W., analyses and determina-		Wolframite	80
tions by	14, 15, 19		
.....	83	X.	
.....	14	Xanthitane	71
ite (?)	45	Xenotime	76
L., analyses and descriptions by, 16, 17,			
19, 20, 44, 45, 55, 59, 67, 72, 73, 74, 75		Y.	
orman, specimen furnished by	17	Yttrocerite (?)	28
L. S., analysis by	55	Yttrotantalite (?)	73
.....	21		
Ellen H., analysis by	73	Z.	
		Zippeite	70
T.		Zircon	49
.....	61	Zoisite	51-52

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J. W. POWELL, DIRECTOR

RECORD

OF

NORTH AMERICAN GEOLOGY FOR 1887 TO 1889 INCLUSIVE

BY

NELSON HORATIO DARTON



WASHINGTON
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1891

LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
POTOMAC DIVISION OF GEOLOGY,
Washington, D. C., June 1, 1890.

SIR: I have the honor to forward herewith a Record of North American Geology for the years 1887 to 1889, inclusive, which is submitted for publication as a bulletin of the Survey.

Very respectfully, your obedient servant,

N. H. DARTON,
Assistant Geologist.

Hon. J. W. POWELL,
Director.



RECORD OF NORTH AMERICAN GEOLOGY FOR 1887 TO 1889.

BY NELSON HORATIO DARTON.

INTRODUCTORY.

The literary scope of this record includes geologic publications printed in North America and publications on North American geology wherever printed. Chronologically it includes publications issued during the years 1887, 1888, and 1889. The List of Publications Examined, page 9, indicates the range of the sources of information.

The entries are comprised in the three following classes, all being arranged in a single alphabetic sequence:

I. *Principal entries*.—Consisting of full titles of separate contributions classified by authors, with subarrangement by dates, together with as much of the usual bibliographic information as appears necessary in a work of this kind. The descriptive note relates only to the geologic contents of the contribution. The size of volume is given only when other than octavo. The extent of papers less than a page in length is indicated thus: $\frac{1}{8}$ p., $\frac{1}{4}$ col., 3 lines.

II. *Titles of containing publications*.—Entered as headings, under which authors' names and short titles of the contained papers are listed in their order of precedence.

III. *Subject references*.—Geographic, stratigraphic, and miscellaneous geologic headings under which abbreviated titles of papers are classified for cross reference to principal entries. A key to these subject references is given on page 8.

KEY TO THE SUBJECT REFERENCES.

Geographic :

- Alabama.
- Alaska, and the other States and Territories.
- Asia.
- Bermudas.
- Canada, comprising all British possessions in North America.
- Central America.
- Europe.
- Hawaiian Islands.
- Mexico.
- New Zealand.
- South America.

Stratigraphic :

- Pleistocene.
- Tertiary.
- Cretaceous, including Laramie and Potomac.
- Jurassic-Triassic.
- Carboniferous, including Permian.
- Devonian.
- Silurian, Upper.
- Silurian, Lower.
- Cambrian.
- Archean, comprising all pre-Cambrian formations.

Miscellaneous :

- Geologic history.
- Geologic philosophy.
- Petrography.

LIST OF PUBLICATIONS EXAMINED.

- American Academy of Arts and Sciences**, Proceedings, vol. 22; vol. 23, part 1.
American Anthropologist, vols. 1, 2. Washington.
American Association for the Advancement of Science, Proceedings, vols. 36, 37. Salem, Mass.
American Geographical Society, Bulletin, vols. 19-21. New York.
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WINCHELL, N. H.
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River, Canada, DODGE.
Subterranean commotion near Akron,
Ohio, CLAYPOLE.
Diabase dikes of Rainy Lake, LAW-
SON.
Cretaceous deposits in Iowa, WHITE,
C. A.
Taconic system as established by
Emmons, MILLER.
On sceptropora, ULRICH.
Niagara shales of western New York,
RINGUEBERG.
Pittsburgh coal bed and its disturb-
ances, WASMUTH.
Geyserite in Nebraska, HICKS.
Archean geology of Missouri, HA-
WORTH.
The reef-builders, HICKS.
Geology in our preparatory schools,
TAYLOR.
Cascade anthracite basin, Rocky
Mountains, DAWSON, G. M.
Later Cretaceous in Iowa, AM. GE-
OLOGIST.
Some American norytes and gabbros,
HERRICH, CLARKE and DEMING.
Taconic question, WINCHELL, A.
Condition of interior of the earth,
CLAYPOLE.

— vol. 2.

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of eastern Canada, MATTHEW.
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WINCHELL.
Antiquity of man, AM. GEOLOGIST.
Huronian of Canada, SELWYN.
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Knowledge of North American East-
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MONS, E.

American Geologist, vol. 2—Continued.

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SELWYN.
Taconic at Boston, HYATT.
Peculiarities of superficial deposits of
northeastern Iowa, MCGEE.
Carboniferous of western Texas,
CUMMINS.
Report of subcommittee on Archean,
FRAZER.
Report of subcommittee on Lower
Paleozoic, WINCHELL.
Use of term Taconic, DANA. WINCH-
ELL, A. SELWYN. WILLIAMS, G. H.
EMERSON. DAWSON, J. W. LE
CONTE. IRVING. HAGUE. BLAKE.
MACFARLANE. EMMONS, S. F.
DUTTON.
Nomenclature of Lower Paleozoic,
FORD. HALL. HITCHCOCK. NEW-
BERRY.
Taconic system of Emmons, WAL-
COTT.
Report of subcommittee on Upper Pa-
leozoic (Devonic), WILLIAMS, H. S.
Report of subcommittee on Upper
Paleozoic (Carbonic), STEVENSON.
Report of subcommittee on Mesozoic,
COOK.
Mesozoic realm, COPE.
Report of subcommittee on Cenozoic
(marine), SMITH.
On use of term "Oligocene," HIL-
GARD.
On absence of Oligocene in Gulf
region, ALDRICH.
White limestone of Gulf region,
JOHNSON.
Relations of Grand Gulf series, HIL-
GARD.
Oligocene in Florida, JOHNSON.
Classification of Tertiary deposits,
HEILPRIN.
Inclusive of Quaternary in Tertiary,
HILGARD.
Nomenclature of Tertiary, NEW-
BERRY. WINCHELL, A.
Use of term "Quaternary," WHIT-
FIELD.
Faunal relations of Tertiary forma-
tions, DALL.
Nomenclature of Cenozoic formations,
LE CONTE.
Report of subcommittee on Cenozoic
(interior), COPE.

American Geologist, vol. 2—Continued.

Report of subcommittee on Quaternary and recent, HITCHCOCK.

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The original Chazy rocks, BRAINERD and SEELY.

Pockets containing clay [etc.] in Niagara at Clinton, Iowa, FARNSWORTH.

Outliers of Cretaceous in Minnesota, WINCHELL, N. H.

Formation of coal seams, AM. GEOLOGIST.

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Well at Keokuk, Iowa, GORDON.

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— Vol. 3.

History of Ozark uplift, BROADHEAD.

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Mount Stephen, B. C., MCCONNELL.

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An unjust attack, FRAZER.

Bull. 75—2

American Geologist, vol. 3—Continued.

Glaciers and glacial radiants CLAYPOLE.

Waverly group in Ohio, HERRICK.

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Well at Davenport, Iowa, TIFFANY.

Barrande and the Taconic, MARCOU.

A new glacial theory, AM. GEOLOGIST.

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Conglomerates in gneiss, WINCHELL, A.

Foliation and sedimentation, LAWSON.

Newark system, RUSSELL, I. C.

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Old channel of Niagara River, SCOVELL.

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Two systems confounded in the Huronian, WINCHELL, A.

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Nickel-bearing rock in Kansas, SNOW.

Relations of Devonian fauna of Iowa, WILLIAMS, H. S.

Glaciation in British Columbia, DAWSON, G. M.

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Conglomerates in gneisses, WINCHELL, A.

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Carboniferous glaciations, WHITE, C. D.

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"Two systems confounded in the Huronian," SELWYN.

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American Geologist, vol. 3—Continued.

Stillwater, Minnesota, deep well, MEADES.

Quaternary of Brazil, MILLS.

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— Vol. 4.

Ore deposit at Treadwell mine, Alaska, DAWSON, G. M., ADAMS.

Iron Butte, Montana, CALVIN.

Camptonite dikes, Washington County, New York, KEMP and MARSTERS.

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Martha's Vineyard, SHALEK.

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Distribution of loess fossils, KEYES.

Taconic of eastern Newfoundland, HOWLEY.

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How is the Cambrian divided? MATTHEW.

The Missouri River, BROADHEAD.

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Origin of certain Cretaceous limestones, HILL, R. T.

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Tertiary and Cretaceous of Alabama, SMITH, E. A., and JOHNSON, L. C.

Rejoinder to Lawson, WINCHELL, A.

Oriskany drift near Washington, District of Columbia, CURTICE.

Southeastern Iowa, GORDON.

Neozoic of southwestern Arkansas, HILL, R. T.

Origin of iron ores of Kewatin in Minnesota, WINCHELL, N. H. and H. V.

American Geologist, vol. 4—Continued.

Cincinnati rocks, history, PERRY.

Methods of stratigraphy in studying the Huronian, WINCHELL, N. H.

Jura, Neocomian, and chalk of Arkansas, MARCOU.

Fence wall geology, FOERSTE.

Origin of petroleum, AM. GEOLOGIST.

Chemical origin of Vermilion Lake iron ores, VAN HISE. WINCHELL, N. H. and H. V.

Geology of the Montmorenci, JAMES.

Deep well at Nampa, Idaho, WRIGHT.

Shells in till near Boston, UPHAM.

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Copper ores of the Southwest, WENDT.

Sierra Mojada, Mexico, CHISM.

Animikie, Duncan mine, Lake Superior, COURTIS.

Geologic map of Europe, FRASER.

Northern coal field of Pennsylvania, HILL, F. A.

Mining on Northwestern Pacific coast, BOWMAN.

Silver mines, Calico, California, LINDGREEN.

Southern cokes and iron ores, MCCREATH and d'INVILLIERS.

Ores of Chattanooga district, FLEMING.

— vol. 16.

Gold and silver mining in Utah, HOLISTER.

Old Telegraph mine, Utah, LAVAGNINO.

Sulphur of southern Utah, FAUR.

Geology of Butte, Montana, EMMONS, S. F.

Rainbow lode, Butte, Montana, BLAKE.

Kaiping coal mines, China, KWONG YUNG KWANG.

Region north of Vermilion Lake district, COMSTOCK.

Chapin iron mine, Lake Superior, LAWSON.

Carbonate iron ores of Mississippi, BRAINERD.

Iron ores of Menomonee range, FULTON.

Pyrite in bituminous coal, BROWN.

Red Mountain district, Ouray County, Colorado, KEDZIE.

American Institute of Mining Engineers, vol. 16—Continued.

Western Kentucky coals and cokes, ALLEN.

Topography and geology of the Cerro de Pasco, Peru, HODGES.

Geological history of Yellowstone Park, HAGUE.

Structural relations of ore deposits, EMMONS, S. F.

Western North Carolina, the Hiawassee Valley, COLTON.

Aluminum ore, Georgia, NICHOLS.

Petroleum and gas in New York, ASHBURNER.

— vol. 17.

Petite Anse salt mine, POMEROY.

Gilsonite from Uintah County, Utah, RAYMOND.

Glenmore iron estate, Greenbrier County, West Virginia, PAGE.

Iron ores of Birmingham district, BRAINERD.

Geology and mines of Aspen Mountain, Colorado, HEURICH.

Alabama coals in 1887, ASHBURNER.

Gypsum in Buffalo, New York, POHLMAN.

Hot spring formations in Red Mountain district, Colorado, COMSTOCK.

Minerals of Ontario, MERRITT.

Life history of Niagara, POHLMAN.

Northwestern Colorado coal region, HEWITT.

Geology of Buffalo, ASHBURNER.

Rosario mine at San Juancito, Honduras, LEGGETT.

Copper deposits of Copper Basin, Arizona, BLAKE.

Ore deposits of Black Hills, Dakota, CARPENTER.

Bernice coal basin, Pennsylvania, CLAGHORN.

Phosphorous in Ludington mine, Michigan, BROWNE.

Nickel ore of Logan County, Kansas, DEWEY.

Ores of Tombstone district, Arizona, GOODALE.

American Journal of Science, vol. 33.

Muir glacier, WRIGHT.

Coal of Rio Grande region, WHITE, C. A.

Lithophysæ and lamination of acid lavas, IDdings.

American Journal of Science, vol. 33—Continued.

Latest volcanic eruption in California, DILLER.

Texture of massive rocks, BECKER.

Geology of western Texas, HILL, R. T.

Volcanic action, DANA, J. D.

Norites of Cortlandt series, WILLIAMS, G. H.

Geology of northern California, DILLER.

Taconic system, WALCOTT.

Card to American geologists, FRAZER.

Fluviatile swamps of New England, SHALER.

Origin of mountain ranges, DANA, J. D.

Faults of southwestern Virginia, STEVENSON.

Taconic rocks and stratigraphy, DANA, J. D.

Irish esker drift, KINAHAN.

Geology of Cross Timbers of Texas, HILL, R. T.

Holocrystalline granitic structure, WILLIAMS, G. H.

Interrelation of fossil faunas and floras, WHITE, C. A.

Eozonal rock, Manhattan Island, GRATACAP.

Terminal moraines in Maine, STONE.

Enlargement of hornblendes and augites, VAN HISE.

Geology of Rainy Lake region, LAWSON.

— vol. 34.

Geology of Michipicoten Bay, HERICK, TIGHT and JONES.

Wappinger Valley limestones, DWIGHT.

Lower Carboniferous of Pennsylvania and Virginia, STEVENSON.

Deposit of glacial drift, HAY.

Well at St. Augustine, Florida, KENNISH.

Serpentine of Syracuse, New York, WILLIAMS, G. H.

Geology of Long Island, DANA, J. D.

Geology of Florida, DALL.

Fauna of "Upper Taconic," WALCOTT.

Is there a Huronian group? IRVING.

Ovibos from loess of Iowa, MCGEE.

Explorations on west coast of Florida, HEILPRIN.

American Journal of Science, vol. 34—
Continued.

- Texas section of Cretaceous, HILL, R. T.
 Animikée - Vermilion unconformity, WINCHELL, A.
 Rounded bowlders along Appalachian rivers, WHITE, I. C.
 Connecticut Lake, EMERSON.
 Blue clay, Farmingham, Maine, ROBINSON.
 Work of International Congress of Geologists, GILBERT.
 Flora of coast islands of California, LE CONTE.
 Vertebrate fossils of Honduras, NASON.
 Ward's flora of the Laramie, LESQUEREUX.
 Archbald pot hole, DANA, J. D.

— vol. 35.

- History of changes in Mount Loa craters, DANA.
 Devonian system in North America, WILLIAMS, H. S.
 Fossils of Littleton, New Hampshire, PUMPELLY.
 Variation in intensity of metamorphism, DANA.
 Diatomaceous earth in Nebraska, HICKS.
 New genus of Sauropoda from Peto-mac formation, MARSH.
 New ammonite and position of Alpine Rhætic, CLARK.
 Three formations of the Middle Atlantic slope, MCGEE.
 The Taconic system of Emmons, and use of term Taconic, WALCOTT.
 Note respecting the term Agnotozoic, CHAMBERLIN.
 Fossils of Littleton, New Hampshire, DANA.
 Diorite dike at Forest of Dean, New York, KEMP.
 Spotted rocks from Pigeon Point, Minnesota, BAYLEY.
 Terminal moraines in north Germany, SALISBURY.
 Gabbros and diorites of Cortlandt series, New York, WILLIAMS, G. H.
 Relations of Laramie group, WHITE, C. A.
 Surface geology of southern Oregon, BIDDLE.

American Journal of Science, vol. 35—
Continued.

- Nickel ores from Oregon, CLARKE, F. W.
 Secondary enlargement of augite in peridotite from Little Deer Islet, Maine, MERRILL, G. P.

— vol. 36.

- History of the changes in the Mount Loa craters, DANA.
 Evidence of plants as to age of Peto-mac formation, WARD.
 Cambrian fossils from Mount Stephen, Canada, WALCOTT.
 Origin of primary quartz in basalt, IDdings.
 Structure of Florida, JOHNSON, L. C.
 Analysis of soil from Washington Territory, SCHNEIDER.
 Rosetown extension of Cortlandt series, KEMP.
 Contact metamorphism produced by Cortlandt series, WILLIAMS, G. H.
 Rhætic plants from Honduras, NEWBERRY.
 Brief history of Taconic ideas, DANA.
 Puget group of Washington Territory, WHITE, C. A.
 On American report of International Congress of Geologists, POWELL.

— vol. 37.

- Iron ores of Penokee-Gogebic series, VAN HISE.
 Halemáuná and its débris cone, DANA, J. D.
 Ascent of Mount Loa, MERRITT, W. C.
 Notes on Mount Loa, BAKER.
 Quartz - keratophyre from Pigeon Point, BAYLEY.
 Hanksite in California, HANKS.
 Geologic history of Maui and Oahu, DANA, J. D.
 Monozite in rocks, DERBY.
 Geology of Fernando de Noronha, BRANNER.
 Restoration of Brontops from the Miocene of America, MARSH.
 Geology of Fernando de Noronha, petrography, WILLIAMS, G. H.
 Deep troughs of oceanic depressions, DANA, J. D.
 Ophiolite of Warren County, New York, MERRILL, G. P.
 Peridotite of Elliott County, Kentucky, DILLER.

American Journal of Science, vol 37—
Continued.

- Plants of Rhode Island coal measures, **LESQUEREUX**.
 Woodham artesian well, Long Island, **LEWIS**.
 Denver Tertiary formation, **CROSS**.
 North American Cretaceous history in Arkansas-Texas region, **HILL, R. T.**
 Phosphorus in Luddington mine, Michigan, **BROWNE**.
 Formation of siliceous sinter in thermal springs, **WEED**.
 Shells in till near Boston, **UPHAM**.
 Stratigraphic position of *Olenellus*, **WALCOTT**.
 Carboniferous flora and fauna in Rhode Island, **PACKARD**.
 Topographic development of Trias of the Connecticut valley, **DAVIS**.
 Petrography of Sandwich Islands, **DANA, E. S.**
 Field studies in the Archean rocks of Minnesota, **WINCHELL, A.**

— **vol. 38.**

- Lencite rock in Wyoming Territory, **HAGUE**.
 Peridotites of Pike County, Arkansas, **BRANNER. BRACKETT**.
 Fishes and plants from Trias of New Jersey and Connecticut valley, **NEWBERRY**.
 Early Cretaceous of the Northwest, **DAWSON, G. M.**
 Porphyrite in northwestern New Jersey, **KEMP**.
 Lava flows and intrusives in the Newark system in New Jersey, **DARTON**.
 Explorations in Dutchess County, New York, **DWIGHT**.
 Carboniferous echinodermata of Mississippi Basin, **KEYES**.
 Grand Gulf formation of the Gulf States, **JOHNSON**.
 Paragenesis of allanite and epidote, **HOBBS**.
 New locality of camptonite, **NASON**.
 Neozoic geology of southwestern Arkansas, **HILL, R. T.**
 Origin of normal faults, **LE CONTE**.
 Classification of middle Cretaceous, **ELDRIDGE**.
 Florida Miocene, **LANGDON**.
 Trap ridges of the East Haven-Bradford region, **HOVEY**.

American Journal of Science, vol. 38—
Continued.

- Lower Cretaceous of the Southwest, **WHITE, C. A.**
 Relations of Uppermost Cretaceous in eastern and southern United States, **HILL, R. T.**
 Skull of gigantic *Ceratopsidæ*, **MARSH**.

American Naturalist, vol. 21.

- New Jersey Cretaceous, **WHITFIELD**.
 Taconic question restated, **HUNT**.
 Warping of the earth's crust, **SPENCER**.
 Formations of Belly River, Canada, **COPE**.
 Geology of Cross Timbers, Texas, **HILL, R. T.**
 Glaciation of Pacific coast, **WRIGHT**.
 Landslide at Brantford, Ontario, **SPENCER**.
 Age of Niagara River, **SPENCER**.
 Taconic Limestones of Canaan, New York, **DWIGHT**.
 Hummocks and boulders of decomposition in Missouri, **SPENCER**.
 Mesozoic and Cenozoic realms of North America, **COPE**.
 Synopsis of the Laramie flora, **WARD**.
 Hill on Cretaceous of Texas, **COPE**.
 Instruction in geology, **WILLIAMS, H. S., DAVIS**.
 International Congress of Geologists, **COPE**.
 Geology of Michipicoten Bay, **HERRICK, TIGHT and JONES**.
 Notes on classification and nomenclature, **WINCHELL, N. H.**
 Glacial flow in Iowa, **WEBSTER**.
 Gilbert's address on work of Geologic Congress, **FRAZER**.
 Sand boulders in Missouri drift, **SPENCER**.
 Materials of the Appalachians, **CLAYPOLE**.
 — **vol. 22.**
 Erosion in Illinois, **SCOVELL**.
 Diameter of the Silurian island about Cincinnati, **DENNIS**.
 Vertebrate fauna of the Puerco epoch, **COPE**.
 Synopsis of Rosenbusch on classification of massive rocks, **BAYLEY**.
 Drift north of Lake Superior, **SPENCER**.

American Naturalist, vol. 22—Cont'd.

- Mountain uplifts, WHITE, C. A.
 Geology of Johnson County, Iowa, WEBSTER.
 Notes on Rockford shales, WEBSTER.
 Holst's studies in glacial geology, LINDAHL.
 Dikes of Hudson River highlands, KEMP.
 Fauna of Permian in Texas, WHITE, C. A.
 Cretaceous floras of northwest Canada, DAWSON, J. W.
 Drift and loess of northern central basin of Iowa, WEBSTER.
 Cascade Mountains of Oregon, COPE.
 Fossils from Rockford shales, Iowa, WEBSTER.
 Surface geology of Burlington, Iowa, KEYES.
 Caves and cave life, KINGSLEY.

— vol. 23.

- Ancient glaciers of North Wales, EVANS.
 Permian of Texas, WHITE, C. A.
 Remarks on occurrence of *Macraster texanus*, HILL, R. T.
 Validity of new species from Texan Cretaceous, HILL, R. T.
 Vertebrate fauna of equus beds, COPE.
 Neighborhood of Seville, LOCKINGTON.
 Occurrence of *Macraster texanus*, HILL, R. T.
 Validity of species from Cretaceous of Texas, HILL, R. T.
 Canadian apatite rocks, ADAMS and LAWSON.
 Across the Santa Barbara channel, FAWKES.
 Devonian of Iowa, WEBSTER.
 Intermediate Pliocene fauna, COPE.
 Pleistocene lake of Nebraska, TODD.
 Cretaceous limestone near Clementon, New Jersey, WOOLMAN.
 Fossil leaves from Arrochar Station, Staten Island, HOLLICK.
 Origin and history of Great Lakes of North America, SPENCER.
 Lavas of Sandwich Islands, DANA, E. S.
 Boulder of Oriskany on Staten Island, GRATACAP.
 Cretaceous near Grassmere station, Staten Island, BRITTON.

American Naturalist, vol. 23—Cont'd.

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 Origin of the loess, CAMPBELL.
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 Surface geology of southwest Virginia, STEVENSON.
 Human footprints from Nicaragua, BRINTON.
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 Geology of Sergipe-Alagoas basin of Brazil, BRANNER.

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Glaciation of mountains in New England and New York, **UPHAM.**

Ascent of Camel's Hump and Lincoln Mountain, Vermont, **UPHAM.**

Archean, comprising all pre-Cambrian formations.

Arizona, Phoenix mine, **RICKETTS.**

Copper basin, **Blake.**

Reymert lode, **BLAUVELT.**

Arkansas, west central, **COMSTOCK.**

Pike County, **BRANNER.**

California, **BECKER.** **GOODYEAR.** **IRELAN.**

Canada, Animikie and Huronian of Lake Superior, **McKELLER.**

Archean—Continued.

Animikie at Duncan mine, **COURTIS.**

Animikie in Thunder Bay region, **INGALL.**

Animikie slates and quartzites, **WINCHELL, N. H.**

anorthosite rocks, **ADAMS.**

At-ta-wa-pish-kat and Albany Rivers, **BELL.**

Baffin Land, **BELL.** **BOAZ.**

Chapin iron mine, Lake Superior, **LARSSON.**

classification of early Cambrian and pre-Cambrian, **IRVING.**

conglomerates in gneisses, **WINCHELL, A.**

correlation of Animikie and Huronian, **McKELLER.**

diabase dikes of Rainy Lake, **LAWSON.**

east of Lake of the Woods, **LAWSON.**

elements of primary geology, **HUNT.**

Eozoic and Paleozoic, **DAWSON, J. W.**

Eozoon Canadense, **DAWSON, J. W., SELWYN.**

foliation and sedimentation, **LAWSON.** **WINCHELL, A.**

Huronian equivalency with Peibidian, **HICKS.**

Hudson Bay, **BELL.**

Huronian at Sudbury, **ATTWOOD.** **BONNEY.**

Huronian, original, **WINCHELL, A.** **WINCHELL, N. H.**

Gastaldi on Italian geology, **HUNT.**

Huronian system, **BELL.** **SELWYN.**

Labrador, cruise to northern, **PACKARD.**

Labrador, Ungava district, **TURNER.**

lecture on geology, **ELLS.**

list of papers, **WINCHELL, N. H.**

Lake Winnipeg to Hudson Bay, **LOW.**

Manitoba borings, **DAWSON, G. M.**

minerals of Quebec, **ELLS.**

Manitoba, Red River valley, **McCHARLES.**

Michipicoten Bay, **HERRICK, TIGHT** and **JONES.**

New Brunswick, **BAILEY** and **McINNES.** **MATTHEW.**

northern part of Dominion of Canada, **DAWSON, G. M.** **RICHARDSON.**

Nova Scotia gold veins, **GILPIN.**

Nova Scotia, Guysborough, Antigonish, and Pictou, **FLETCHER.**

Archean—Continued.

- Nova Scotia, Halifax, and Colchester, HONEYMAN.
 Nova Scotia, Kings County, HONEYMAN.
 Ontario, Beaver mine, BRENT.
 Ontario, iron and other ores, IVES.
 Ontario, minerals, MERRITT.
 Ontario, rocks from, analyses, RIGGS.
 Ontario, sheet 113, COSTE.
 Ottawa, sequence of formations about, AMI.
 Portions of eastern township of Canada, ELLS.
 recent development in Archean geology, LAWSON.
 Quebec, eastern, SELWYN.
 relations to Paleozoics in Quebec, LAFLAMME.
 rocks containing scapolite, ADAMS and LAWSON.
 Rainy Lake region, LAWSON.
 schist from Lake of the Woods, analysis, ADAMS.
 Sudbury copper deposits, COLLINS.
 unconformities of the Animikie, WINCHELL, A.
 Thunder Bay silver mines, BELL.
 stratigraphy of the Huronian, WINCHELL, N. H.
 two systems confounded in the Huronian, SELWYN.
 Vancouver's Island, DAWSON, G. M.
Colorado, Aspen, BRUNTON. EMMONS.
 S. F., LAKES. SEVIER.
 Corundum schist, SMITH, W. B.
 Crested Butte, LAKES.
 Boulder County, VAN DIEST.
 Denver region, ELDRIDGE.
 Eagle County, OLCOTT.
 geology of Colorado ore deposits, LAKES.
 iron resources of Colo., CHAUVENET.
 Leadville region, EMMONS, S. F. IHLSENG. BLOW.
 Onray County, KEDZIE.
Connecticut, Taconic region, DANA, J. D. WALCOTT.
 map of vicinity of New York city, MARTIN.
 metamorphism near New Haven, DANA, J. D.
Dakota, Black Hills, CARPENTER. CROSBY.
Idaho, on road to Atlanta, THOMSON.

Archean—Continued.

- Maine*, Eastport region, SHALER.
Maryland, Archean geology, WILLIAMS, G. H.
 Baltimore gabbros, WILLIAMS, G. H.
 Baltimore region, WILLIAMS, G. H.
 mineralogy, WILLIAMS, G. H.
 rocks near Ilchester, HOBBS.
Massachusetts, Bristol County, SHALER.
 geological recreation in central Massachusetts, HONEYMAN.
 Great Barrington, JULIEN.
 conglomerates in gneisses, HITCHCOCK.
 Essex region, SEARS.
 Hampshire County, EMERSON.
 limestones of eastern, HUNT.
 Nahant, LANE.
 Taconic region, DANA, J. D. WALCOTT.
 Salem, SEARS.
Mexico, Baja California, LINDGREN.
Michigan, classification of Cambrian and pre-Cambrian, IRVING.
 Archean of the Northwest, WINCHELL, A.
 correlation of Animikie and Huronian, MCKELLER.
 gold field, PARKER.
 granite and quartzite contact at Ironwood, WINCHELL, N. H.
 granites of the Northwest, HALL, C. W.
 great primordial quartzite, WINCHELL, N. H.
 Irving and Chamberlin on Lake Superior sandstones, AM. GEOLOGIST.
 is there a Huronian group? IRVING.
 list of papers, WINCHELL, N. H.
 metamorphism of eruptives on south shore of Lake Superior, WILLIAMS, G. H.
 Menominee range, FULTON.
 northwestern, WINCHELL, A.
 WINCHELL, N. H.
 Penoque-Gogebic iron ores, VAN HISE, IRVING, ENG. AND MINING JOURNAL.
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 recent developments in Archean geology, LAWSON.
 Taconic system, MILLER.
Minnesota, Animikie slate and quartzite, WINCHELL, N. H.

Archean—Continued.

Archean rocks of the Northwest,
WINCHELL, A.
bibliography, WINCHELL, N. H.
central counties of, UPHAM.
classification of Cambrian and pre-
Cambrian, IRVING.
crystalline rocks, WINCHELL, N. H.
copper mining, HALL, C. W.
correlation of Animikie and Huron-
ian, MCKELLER.
diabasic schists with jaspilite,
WINCHELL, H. V.
foliation and sedimentation, LAW-
SON, WINCHELL, A.
Geological report, 1886, WINCHELL,
N. H.
granites of the Northwest, HALL,
C. W.
great primordial quartzite, WINCH-
ELL, N. H.
iron regions, 1888, WINCHELL, H. V.
Irving and Chamberlin on Lake Su-
perior sandstones, AM. GEOLOGIST.
is there a Huronian group? IRVING.
Ludington mine, BROWNE.
natural gas wells, WINCHELL, N. H.
northern, WINCHELL, N. H.
northeastern, GRANT. WINCHELL, A.
WINCHELL, N. H.
northwestern, WINCHELL, H. V.
norytes and gabbros, HERRICK,
CLARKE and DEMING.
origin of the Keewatin ores, DAW-
SON, G. M.
peridotites, gabbros, diabases and
andesites, WADSWORTH.
Pigeon Point, BAYLEY, W. S.
report, Lake Superior division,
IRVING.
Stillwater well, MEADES.
Taconic system, MILLER.
thoughts on eruptives, WINCHELL,
N. H.
unconformities of the Animikie,
WINCHELL, A.
Vermilion Lake region, IRVING,
WINCHELL, N. H., WINCHELL, H.
V., VAN HISE.
Missouri, Archean geology, HAWORTH.
Montana, Butte, EMMONS, S. F.
Nebraska, well in Pawnee County, RUS-
SELL, F. W.
Nevada, BECKER.

Archean—Continued.

New Hampshire, conglomerates in
gneisses, HITCHCOCK.
New Jersey, artesian wells, COOK.
Britton on Archean, RAYMOND.
crystalline rocks, BRITTON.
geologic surveys, COOK.
map, COOK. MARTIN.
Montville serpentine, MERRILL, G. P.
plant from limestone of Sussex
County, BRITTON.
recent field work, BRITTON.
New Mexico, Zuni plateau, DUTTON.
New York, borings on Staten Island,
BRITTON. HOLLICK.
building stones, HALL. SMOCK.
contact metamorphism in rocks ad-
joining Cortlandt series, WILLIAMS,
G. H.
Cortlandt series, CALLAWAY.
HARKER. WILLIAMS, G. H.
dikes of Hudson River Highlands,
KEMP.
diorite dike, Forest of Dean, KEMP.
distinctive features of New York Isl-
and and Highland gneisses, MAR-
TIN. BRITTON.
Dutchess, Putnam, and Westchester
counties, SMOCK.
Eozoonal rock on Manhattan Island,
GRATACAP.
gabbros and diorites of the Cort-
landt series, WILLIAMS, G. H.
geology of Staten Island, BRITTON.
Hoboken serpentine, BRITTON.
kersantite at Croton, NEWBERRY.
Little Falls, HALL.
map of vicinity of New York city,
MARTIN.
Mohawk Valley, BEECHER and HALL.
ophiolite, MERRILL, G. P.
Rosetown extension of Cortlandt
series, KEMP.
well at Woodham, Long Island,
LEWIS.
well at Woodhaven, Long Island,
BRYSON.
serpentes of Staten Island, BRIT-
TON. CHAMBERLIN. GRATACAP.
Nomenclature and classification, classi-
fication of the Cambrian and pre-
Cambrian, IRVING.
Archean of the Northwest, WINCH-
ELL, A.

Archean—Continued.

- classification of crystallines west of Lake Superior, LAWSON.
 correlation of Animikie and Huronian, MCKER.
 Gastaldi on Italian geology, HUNT.
 crystalline rocks, HUNT.
 elements of primary geology, HUNT.
 equivalency of Huronian with Peibidian, HICKS.
 genetic history of crystallines, HUNT.
 geological questions, FRAZER.
 Frazer on subdivisions, SCIENCE.
 Huronian system in Canada, BELL.
 relations of Canadian to European, DAWSON, J. W.
 report of subcommittee, International Congress of Geologists, FRASER (*et al.*).
 history of name Huronian, DANA, J. D.
 is there a Huronian group? IRVING.
 recent developments in Archean geology, LAWSON.
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 stratigraphy of the Huronian, WINCHELL, N. H.
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 residue from decay of schists near Cary, analysis, RIGGS.
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 geology of west central, BRANNER. COMSTOCK.

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O. P.

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gas and oil; records of drillings in Allegany,
Tompkins, Wayne, Ontario, Albany, and
Greene counties, and at Buffalo, Fredonia,
Utica, Oswego and Onondaga; discussion of
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tions pierced and horizon of oil and gas-bearing
beds in Pennsylvania; description of sections
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ada, and of the Catskill Mountain region;
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Paleozoic members in New York, Pennsylv-
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— The composition of Kansas coals.

Kansas Acad. Sci., Trans., vol. 11, pp. 46-49. 1889.

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Canadian Record of Science, vol. 2, p. 430, $\frac{1}{2}$ p. 1887.

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— On the Silurian system of northern Maine, New Brunswick, and Quebec.

Canada, Royal Soc., Trans., vol. 4, sec. IV, pp. 35-41, 4°. 1887.

Reviews former opinions, describes the relations, and discusses age, equivalency, and extent of the "Silurian and Cambro-Silurian," as exposed in the Fish River Lake region in northern Maine (as described by Packard), and the Becaguimic and Temisconta regions.

— Notes on the physiography and geology of Aroostook County, Maine.

Canada, Roy. Soc., Trans., vol. 5, sec. IV, pp. 39-44, 4°. 1888.

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— On some relations between the geology of Maine and New Brunswick.

Canadian Record Science, vol. 3, pp. 165, 166. 1888. Abstract of paper read to Royal Society of Canada.

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Am. Jour. Sci., 3d series, vol. 35, pp. 338-393. 1888.

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Am. Jour. Sci., 3d series, vol. 37, pp. 54-63. 1889.

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Am. Geologist, vol. 2, pp. 407-412. 1888.

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— Notice of some new and remarkable forms of Crinoidea from the Niagara limestone at St. Paul, Decatur County, Indiana.

Am. Geologist, vol. 4, pp. 102-103. 1889.

Includes reference to some of the relations of the beds in which they occur.

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Minnesota Acad. Sci., Bull., vol. 3, part 1, pp. 58-63. 1889.

A preglacial river channel and its history, age, origin, relations, and characteristics of some clay deposits formerly thought to be Cretaceous.

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U. S. Geol. Survey, Sixth Annual Report, 1884-'85, pp. 67-70. 1885.

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— Geology of the quicksilver deposits of the Pacific slope.

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Description of the characteristics of the unaltered and the metamorphosed sediments and the massive rocks and synopsis and discussion of the stratigraphy, general geologic relations, taxonomy and geologic history of California formations, especially in the Coast Ranges; detailed descriptions and discussions of the relations in each of the principal quicksilver districts in California and at Steamboat Springs, Nevada, and references to various other American and foreign localities. Discussion of history, date, results, and conditions affecting metamorphism in the region; origin of serpentines, the nodules in the sandstones, and the massive rocks; relations of the volcanics in general and in the several districts; the geologic relations, associations, and genesis of the ores, and the nature and nomenclature of ore veins, and the genesis of ores in general. Accompanied by colored geologic maps.

— Report, California division of geology.

U. S. Geol. Survey, Seventh Report, J. W. Powell, 1885-'86, pp. 93-97. 1888.

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New York, Thirty-ninth Report State Museum of Nat. Hist., 1885, pp. 161-163, plate. 1886.

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[— and **HALL, C. E. ?**]. Field notes on the geology of the Mohawk Valley.

New York, Fifth Report of the State Geologist, 1885, pp. 8-10, map. 1887.

Describes a series of faults and the relations of the crystalline to the overlying rocks. Accompanied by a folded, partly colored geologic map.

[— **HALL, J. W.** and **HALL, C. E. ?**]. Note on the Oneonta sandstone in the vicinity of Oxford, Chenango County, New York.

New York, Fifth Report of the State Geologist, 1885, p. 11. 1887.

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BELL, Robert. Marble Island and the northwest coast of Hudson's Bay.

Canadian Inst., Proc., 3d series, vol. 4, pp. 192-204, 2 plates. 1887.

Abstract, Scottish Geog. Mag., vol. 3, p. 321, $\frac{1}{2}$ p. 1887.

Describes supposed Huronian quartzite, glaciation, and ancient beaches on the island and in its vicinity, and a series of rock specimens, supposed to be Huronian, from the coast of the bay. Discusses the direction of glacial flow in the Hudson's Bay region.

— On some points in reference to ice phenomena.

Canada, Royal Soc., Trans., vol. 4, section III, pp. 85-91. 4°. 1887.

Discusses the transportation of debris by icebergs, field ice, and anchor ice; the formation of boulder rings around ponds, and the occurrence of dikes of boulders and shingle on the shores of islands and points.

— Rock specimens from Cumberland Sound, Baffin Land.

Science, vol. 10, p. 287. 1887.

Gneisses, limestone, graphite, and quartz, which are considered representatives of Laurentian, similar to that on the north side of Hudson Strait and the lower Ottawa Valley.

— The silver mines of Thunder Bay, Lake Superior.

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— The Huronian system of Canada.

Am. Geologist, vol. 2, p. 361, $\frac{1}{2}$ p. 1888.

Abstract of paper read to Royal Society of Canada. 1888.

Discussion of the indivisibility of the Huronian.

— Report on an exploration of portions of the At-ta-wa-pish-kat and Albany Rivers, Lonely Lake to James' Bay.

Canada, Geol. and Nat. Hist. Survey, Report 1886, part G, p. 38, plates. 1887.

Abstracts, *ibid.*, part A, pp. 22-26. Geol. Magazine, III, vol. 6, p. 134, $\frac{1}{2}$ p. 1889.

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— The petroleum field of Ontario.

Canada, Roy. Soc., Trans., vol. 5, section IV, pp. 101-113, 4°. 1888.

Discussion of the conditions affecting the occurrence of petroleum, the extension of the Cincinnati anticlinal in Canada and its history, and the structure of the Ontario region.

— The origin of some geographical features in Canada.

Canadian Record Sci., vol. 3, pp. 163-165. 1888.

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— Presidential address: The Huronian system in Canada.

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— On the Archean. See **FRAZER**. Report on Archean.**Bermudas, origin of present form, FEWKES. HEILPRIN.****BIDDLE, H. J.** Notes on the surface geology of southern Oregon.

Am. Jour. Sci., 3d series, vol. 35, pp. 475-483. 1888.

BIDDLE, H. J.—Continued.

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BISHOP, Irving P. Salt wells of western New York.

New York, Fifth Report of the State Geologist, 1885, pp. 12-47. 1887.

Gives a series of well records; discusses the extent, horizon, and origin of the salt deposits.

BLAKE, William P. Iron ore deposits of southern Utah.

Am. Inst. Mining Engineers, Trans., vol. 14, pp. 809-811. 1886.

Brief reference to nature of associated formations.

— The rainbow lode, Butte City, Montana.

Am. Inst. Mining Engineers, Trans., vol. 16, pp. 65-80. 1887.

Describes the granite and its constituents, the trachyte or porphyry outburst of the "Butte," and the character, course, faults, variations, and minerals of the lode; discusses vein formation and rock decomposition.

[—] [On the use of the term "Taconic."]

International Congress of Geologists, Am. Committee Report, 1888, B, p. 17, 2 lines.

Am. Geologist, vol. 2, p. 207. 1888.

Suggestion in regard to its application.

— The copper deposits of the Copper Basin, Arizona, and their origin.

Am. Inst. Mining Engineers, Trans., vol. 17, pp. 479-485. 1889.

Includes a brief description of the geologic relations.

— On the Archean. See **FRAZER**, Report on Archean.**BLAUVELT, Harrington.** The Rymert manganiferous lode, Arizona, and its formations.

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— See also **SPENCER, James.****Boston Society of Natural History, Memoirs, vol. 4.**

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— **Proceedings, vol. 23.**

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Date of report on geology of Vermont, **HITCHCOCK, MARCOU**.

Geology of Nahant, **LANE**.

Marine shells in till near Boston, **UPHAM**.

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Pot holes at Cohasset, BOUVÉ, UPHAM.

Structure of drumlins, UPHAM.

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Boston Soc. Nat. Hist., Proc., vol. 24, pp. 218-226. 1889.

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BOWMAN, Amos. Mining developments on the northwestern Pacific coast and their wider bearing.

Am. Inst. Mining Engineers, Trans., vol. 15, pp. 707-717. 1887.

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— [Preliminary report on the Caribou gold-bearing district, British Columbia.]

Canada, Geol. and Nat. Hist. Survey, Report, 1886, part A, pp. 5-7. 1887.

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— Testimony of Ottawa clays and gravels to the expansion of the Gulf of St. Lawrence and Canadian lakes within the human period.

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BRACKETT, Richard N.—Continued.

Abstract, Am. Naturalist, vol. 23, p. 721, 1 p. 1889.

Petrographic description of the several rocks from the locality.

— See, also, **BRANNER, John C.** and

BRAINERD, Alfred F. A new discovery of carbonate iron ores at Enterprise, Mississippi.

Am. Inst. Mining Engineers, Trans., vol. 16, pp. 146-149. 1887.

Reference to mode of occurrence, thickness, etc. Analyses.

— Notes on the iron ores, fuel, and improved blast-furnace practice of the Birmingham district.

Am. Inst. Mining Engineers, Trans., vol. 17, pp. 151-155. 1889.

Includes analyses of limestones and Clinton iron ores.

BRAINERD, Ezra and **SEELY, H. M.** The original Chazy rocks.

Am. Geologist, vol. 2, pp. 323-330. 1888.

Detailed description of stratigraphy and structure in Chazy, New York, accompanied by map and cross sections. Discussion of possibility of fault separating the Chazy from the Potadam and cutting off the Calciferous beds.

BRANNER, John C. Annual Report of the Geological Survey of Arkansas for 1887, pp. 15, 8°. Little Rock, 1887.

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— Glaciation: its relations to the Lackawanna-Wyoming region.

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Sketch of the glacial history of the region, and discussion of glacial theories, origin of drifts, causes of glacial cold, etc.

— Notes upon the glacial striae observed in the Wyoming-Lackawanna region.

Lackawanna Inst. Hist. and Science, Pub., vol. 1, pp. 19-27. 1887.

List of striae, in some instances with suggestions in regard to the significance of their direction.

— Introduction to the report upon western central Arkansas.

Arkansas, Geol. Survey, Report for 1888, vol. 1, pp. XXIX-XXXI. 1888.

Incidentally discusses the extent and relations of the axes of the flexures.

— On the manufacture of Portland cement.

Arkansas, Geol. Survey, Report for 1888, vol. 2, pp. 291-302. 1888.

BRANNER, John C.—Continued.

Includes tables of analyses of Arkansas chalks and clays.

— **The Geology of Fernando de Noronha, part I.**

Am. Jour. Sci., 3d series, vol. 37, pp. 145-161, pl. v. 1889.

Topography, distribution, structure, and relations of the several volcanic rocks and account of calcareous sandstones at various points along the coast.

— **The age and correlation of the Mesozoic rocks of the Sergipe-Alagoas basin of Brazil.**

Am. Assoc. Adv. Science, Proc., vol. 37, pp. 187-188, $\frac{1}{2}$ p. 1889.

Paleontologic characteristics of the several zones of the series and age of adjoining formations.

— **The age of the crystalline rocks of Arkansas.**

Am. Assoc. Adv. Science, Proc., vol. 37, p. 188, $\frac{1}{2}$ p. 1889.

Evidence of their intrusive nature and age.

— **The peridotite of Pike County, Arkansas.**

Am. Jour. Sci., 3d series, vol. 38, pp. 50-56, plate. 1889.

Local geology, illustrated by colored map; relations and date of intrusion of peridotite and sketch of geologic history of the region.

— **and BRACKETT, R. N. The peridotites of Pike County, Arkansas.**

Am. Assoc. Adv. Science, Proc., vol. 37, pp. 188-189, $\frac{1}{2}$ p. 1889.

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glacial boulders of our fisheries, HONEYMAN.

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graptolites from St. Lawrence River region. LAPWORTH.

how is the Cambrian divided? MATTHEW.

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New Brunswick, BAILEY and MCINNES. BAILEY.

northern part of Dominion, DAWSON, G. M.

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Leadville region, EMMONS, S. F. IHLENG, BLOW.

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Cambrian—Continued.

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 well at Washington, CALVIN.
 well at Davenport, TIFFANY.
 Keokuk deep boring, GORDON.
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 Bristol County, SHALER.
 geology of Nahant, LANE.
 Great Barrington, JULMEN.
 horizon of Nahant limestone,
 FOERSTE.
 outer islands of Boston Harbor,
 CROSBY.
 Taconic region, DANA, J. D. WAL-
 COTT.
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 WINCHELL, N. H.
 Irving and Chamberlin on Lake Su-
 perior sandstone, AM. GEOLOGIST.
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 quartzite, WINCHELL, N. H.
 artesian wells, HALL, C. W.
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 Tail, Mille Lacs, and Kanabec,
 Pine and Becker counties, UP-
 HAM.
 descriptions of some maps, UPHAM.
 Fossils in red quartzite, WINCHELL,
 N. H.
 Great primordial quartzite, WINCH-
 ELL, N. H.
 Minnesota and Mississippi Valleys,
 WINCHELL, N. H.
 Minneapolis and St. Paul region,
 HALL, C. W.
 Stillwater deep well, MEADES.
 Wabasha, Goodhue, Dakota, Hen-
 nepin, and Washington Counties,
 WINCHELL, N. H.
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 BROADHEAD.
- Montana*, Drumlunnon veins, CLAY-
 TON.
 Gallatin region, HAYDEN.
- Nebraska*, well at Lincoln, RUSSELL,
 F. W.
- Nevada*, WALCOTT.
 marbles, NEWBERRY.

Cambrian—Continued.

- stratigraphic position of *Olenellus*,
 WALCOTT.
- New Jersey*, geological map, COOK,
 MARTIN.
- New York*, building stones, SMOCK.
 Calciferous fossils of Lake Cham-
 plain, WHITFIELD.
 Camptonite dike, Washington
 County, KEMP and MARSTERS.
 Cambrian trilobites from Poughkeep-
 sie, NEWBERRY.
 Dutchess County, DWIGHT.
 Dutchess, Putnam, and Westchester
 counties, SMOCK.
 great primordial quartzite, WINCH-
 ELL, N. H.
 original Chazy rocks, BRAINERD and
 SEELY.
 stratigraphic position of *Olenellus*,
 WALCOTT.
- Taconic region, DANA, J. D. WAL-
 COTT.
 Washington County, WALCOTT.
 well near Utica, WALCOTT.
 Wappinger Valley and Stissing
 Mountain, DWIGHT.
- Nomenclature and classification*, classi-
 fication and use of term "Taconic,"
 BLAKE. DANA, J. D. DAWSON,
 J. W. DUTTON. EMERSON. EM-
 MONS, S. F. FORD. FRAZER.
 HAGUE. HALL. HITCHCOCK. IRV-
 ING. NEWBERRY. SELWYN. WAL-
 COTT. WILLIAMS, G. H. WIN-
 CHELL, A. WINCHELL, N. H.
- Barrande and the Taconic, MARCOU.
 Canadian geological classification in
 Quebec, by MARCOU. SELWYN.
 classification by the American com-
 mittee, WINCHELL, N. H.
 classification in Acadia, MATTHEW.
 crystalline schists, HUNT.
 elements of Primary geology, HUNT.
 geological questions, FRAZER.
 history of Taconic ideas, DANA, J. D.
 how is the Cambrian divided? MAT-
 THEW.
- objections to the term Taconic con-
 sidered, WINCHELL, N. H.
 on crystalline schists, HUNT.
 position of *Olenellus* beds, NATHORST.
 principles of the adversaries of the
 Taconic, MARCOU.

Cambrian—Continued.*New York—Continued.*

report of subcommittee on Paleozoic,
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gists, WINCHELL, N. H.

some forgotten Taconic literature,
VOGDÉS.

stratigraphic position of Olenellus,
WALCOTT.

Taconic of Boston, HYATT.

Taconic of Emmons, NEWBERRY.

Taconic question, HUNT. WINCH-
ELL, A.

Taconic system, MILLER.

Walcott on the Cambrian, HICKS.
HUNT. MARCOU. SCIENCE. WIN-
CHELL, N. H.

North Carolina, Hiawassee Valley, COL-
TON.

King's Mountain region, VAN NESS.

Ohio, southwestern, JAMES.

Pennsylvania, Cumberland-Lebanon
Valley, D'INVILLIERS.

four great sandstones, CLAYPOLE.

origin of Appalachian materials,
CLAYPOLE.

Philadelphia region, RAND.

Radnor Township, Delaware County,
RAND.

Tennessee, marble of Hawkins County,
WILLIS.

East Tennessee, BRITTON.

Texas, HILL, E. T., WALCOTT.

Utah, old Telegraph mine, LAVAGNINO.

Wahsatch section, WALCOTT.

stratigraphic position of the Olenel-
lus, WALCOTT.

Vermont, dates of reports on geology of
Vermont, MARCOU. HITCHCOCK.

fossils in Lower Taconic of Emmons,
WALCOTT.

Taconic of Georgia and report on the
geology of Vermont, MARCOU.

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DANA, J. D.

Virginia, New River-Cripple Creek re-
gion, D'INVILLIERS and McCREATH.
STEVENSON.

Balcony Falls and Great Valley,
BRITTON.

Wisconsin, great primordial quartzite,
WINCHELL, N. H.

CAMPBELL, John. T. Origin of the
loca.

CAMPBELL, John T.—Continued.

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Woods, ADAMS.

ancient shore lines near Toronto, IVES.
Animikie and Huronian of Lake Su-
perior, MCKELLAR.

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COURTIS.

Animikie slate and quartzites, WINCH-
ELL, N. H.

anorthosite rocks, ADAMS.

Anticosti shell marl, analysis, ADAMS.

apatite-bearing rocks, HUNT. SHUTT.

Archean rocks of the Northwest,
IRVING. LAWSON. WINCHELL, A.

Arctic currents and ice as factors in
geology, GASKING.

At-ta-wa-pish-kat and Albany rivers,
BELL.

Aylesford, Kings County, HONEY-
MAN.

Baffin Land, BOAZ.

basal series of Cambrian in Acadia,
MATTHEW.

Beaver mine, Ontario, BRENT.

borings in Manitoba, etc., DAWSON,
G. M.

boulder in Halifax coal, SPENCER.
JAMES.

Cambrian of Cape Breton and New-
foundland, MATTHEW.

Carboniferous of Cape Breton, GIL-
PIN.

Caribou mining district, British Co-
lumbia, BOWMAN.

Cascade anthracite basin, DAWSON,
G. M.

Cape Breton, GILPIN.

Chazy at Aylmer, Quebec, SOWTER.

classification of Cambrian rocks of
Acadia, MATTHEW.

classification of early Cambrian and
pre-Cambrian, IRVING.

coal of Vancouver Island, ADAMS.

coal-bearing rocks, ADAMS.

coal and slates of Pacific Coast,
BOWMAN.

coal in valley of Bow River, DODGE.

Canada—Continued.

conglomerates in gneisses, WINCHELL, A.
 copper mining at the Cove, Newfoundland, GARLAND.
 correlation of Animikie and Huronian, MCKELLAR.
 Cretaceous floras of northwest, DAWSON, J. W.
 Cretaceous plants, Vancouver Island, DAWSON, G. M. DAWSON, J. W.
 cruise to northern Labrador, PACKARD.
 Dawson on Quaternary and glaciation, RICHARDSON.
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 Dawson on geology of Northwest Territory, RICHARDSON.
 deposits of phosphate of lime, PENROSE.
 diabase dikes of Rainy Lakes, LAWSON.
 drift north of Lake Superior, SPENCER.
 earlier Cretaceous of northwestern, DAWSON, G. M.
 Eozoic and Paleozoic, DAWSON, J. W.
 Eozoon Canadense (geology of Laurentian), DAWSON, J. W. SELWYN.
 equivalency of Huronian with Peibidian, HICKS.
 expansion of Gul of St. Lawrence and Canadian lakes, BOWMAN.
 explorations in portions of New Brunswick, BAILEY and MCINNES.
 foliation and sedimentation, LAWSON. WINCHELL A.
 faults and foldings of Pictou coal-field, GILPIN.
 fauna of St. John group, MATTHEW.
 fossils in the city of Quebec, FORD.
 fossil woods from western, DAWSON, J. W.
 geology of the Montmorenci, EMMONS, E. JAMES. AM. GEOLOGIST.
 geology of Winnipeg region, MCCHARLES.
 geology of vicinity of Quebec, MARCOU.
 geology of Mount Stephen, B. C., MCCONNELL.
 geology of Russell and Cambridge, Ontario, AMI. CRAIG.
 glacial geology of Nova Scotia, HONEYMAN.

Canada—Continued.

glacial boulders of our fisheries, HONEYMAN.
 glaciation on Pacific Coast, WRIGHT.
 glaciation of eastern Canada, CHALMERS.
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 glacier region, Selkirk range, British Columbia, GREEN.
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— and **SALISBURY, R. D.** Preliminary paper on the driftless area of the Upper Mississippi valley.

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— The peridotite of Elliott County, Kentucky.

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— Three coals from Gulf, North Caro-
lina.

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No. 42. 1887.

Analyses.

— Some nickel ores from Oregon.

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dam across the Ohio and the probable size, out-
let, duration, dissolution, and deposits of the
"Lake Ohio" to which it gave rise. Follows
the retreat of the glacier to the borders of Lake
Erie and describes a series of lakes which
must then have extended from the glacier
front southward to the divide and emptied
into affluents of the Ohio. Discusses the rela-
tion of these lakes to each other at their sev-
eral stages, and to the adjacent and subse-
quent drainage and topography. Considers the
extent and history of the successive drainage
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— The materials of the Appalachians.

Am. Naturalist, vol. 21, pp. 955-962, 1054-
1060. 1887.

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sylvania, calling attention to the present
small areas of pre-Paleozoic rocks and discuss-
ing its probable former extent and the promi-
nent presence of the quartzose rocks which
supplied materials for the conglomerates and
sandstones. Describes the extent, variations
in thickness and coarseness of materials in
the several sandstone series, and advances a
hypothesis of successive uplifts of quartzose
"Archean" rocks at the beginning of the
deposition of each of these series. Discusses
the position and character of these uplifts and
the mode of deposition of the sediments.

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Am. Assoc. Adv. Science, Proc., vol. 36, p. 218. 1888.

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- The eccentricity theory of glacial cold versus the facts.

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- Glaciers and glacial radiants in the ice age.

Am. Geologist, vol. 3, pp. 73-94. 1889.

A general discussion of the conditions, extent, and results of glaciation in North America and elsewhere.

- The story of the Mississippi-Missouri.

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A general sketch of the geologic history of North America with especial reference to the Mississippi-Missouri region.

- Falls of rock at Niagara.

Nature, vol. 39, p. 367, $\frac{1}{2}$ col. 1889.

Cites newspaper accounts of the fall of great masses from the edge of the shelf over which Niagara falls, and expresses opinion in regard to the mean rate of recession.

CLAYTON, Joshua E. The Drum-lummon group of veins and their mode of formation.

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Eng. and Mining Jour., vol. 46, pp. 85-86, 106-108, 4^o. 1888.

Extract from report to Montana Company of London.

Description of geologic relations at contact of granite and metamorphic beds. Discussion of the origin and history of the mineralization.

- The Cœur d'Alene silver-lead mines.

Eng. and Mining Jour., vol. 45, pp. 108-109, 4^o. 1888.

Description of geology of region and discussion of structural relations.

- [CLERC, F. L.] The lead and zinc ores of southwest Missouri.

Eng. and Mining Jour., vol. 43, pp. 397-398. 1887.

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Manchester Geol. Soc., Trans., vol. 19, pp. 326-353, pls. 1-5, pp. 431-433. 1888.

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General description of the structure and stratigraphy of the field, including numerous quotations from previous writers. Discussion of the origin and extent of the coal and coke, and relation of the coal measures to adjoining formations, accompanied by maps and sections at Clover Hill, Midlothian, Black Heath, and Deep Run.

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— Notes on the region north of the Vermilion Lake district in British Columbia.

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— Hot spring formations in Red Mountain district, Colorado; a reply to the criticisms of Mr. Emmons.

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traps of Connecticut Valley, DAVIS and WHITTLE.

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COOK, George H. Archean or primitive rocks.

Geol. Survey of New Jersey, Report of the Geologist for 1886, pp. 70-74. 1887.

General description of the topographic and structural features of the crystalline rocks of the Highlands of New Jersey; introductory to Britton's report.

[—] Triassic.

Geol. Survey New Jersey, Report of the Geologist for 1886, pp. 123-127. 1887.

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Reviewed, *Science*, vol. 9, pp. 595-596. 1887.

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[—] Surface geology.

Geol. Survey of New Jersey, Report of the Geologist for 1886, pp. 127-129. 1887.

Introductory to Merrill's report on the yellow gravel; describes its distribution, character, and relations to associated formations.

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Describes some geologic features in several magnetite mines, and at the hematite mine on Marble Mountain, Warren County.

[—] Greensand marls.

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Reprinted from the report of the State Geologist to the State Board of Agriculture in 1876. Statements in regard to geographic extent, geologic structure, thickness, age, composition, clay marls, red sand bed, and use, and detailed descriptions of openings in the middle and upper marl beds.

[—] Geologic surveys.

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— Artesian wells.

Geol. Survey of New Jersey, Report of Geologist for 1887, pp. 25-27. 1887.

Includes reference to wells in red sandstone near Hoboken, and through clay to gneiss at Sayreville.

— Report of the subcommittee on Mesozoic.

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Reference to position and characteristics of the Triassic and Cretaceous of the Eastern United States, absence of separable Jurassic, and use of terms group and series. Includes tables of opinions in regard to equivalency of Trias of New Jersey, Virginia, and North Carolina, and the Cretaceous and its subdivisions in New Jersey, Alabama, Mississippi, Texas,

COOK, George H.—Continued.

interior North America, and the Canadian Rocky Mountains.

— On the International Geologic Congress and our part in it as American geologists.

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— Geological map of New Jersey, from original surveys. Scale, 5 miles to an inch. 1889. Atlas sheet No. 20. 34 by 25 inches.

Colored map with two cross-sections. Differs from map published with 1882 report as follows: Wider extension of the larger coastal alluvial areas, outlying area of Cretaceous (Potomac?) near Monmouth Junction, Hudson River slates area, and alteration in Triassic boundary near Clinton and Brookville, additional small volcanic areas near Beemer-ville, and in the Triassic region, several small crystalline limestone areas near Danville, northward extension of the First Watchung trap area, and many slight local corrections of boundary lines.

[—] On the Triassic or red sandstone rocks.

Geol. Survey of New Jersey, Report for 1888, pp. 11-15. 1889.

Statement of general characteristics of the formation, discussion of the occurrence of faults and expression of opinion in regard to the nature of the trap rocks.

[—] Artesian wells.

Geol. Survey of New Jersey, Report for 1888, pp. 72-77. 1889.

Gives records of 1,150-foot well at Atlantic City, 380-foot well at Sea Island City, 155-foot well near Marlton, and a 450-foot well in Jersey City.

COOPER, J. G. Catalogue California fossils.

California, Seventh Report of the State Mineralogist, pp. 223-308. 1888.

Compilation. References to stratigraphic positions.

COPE, E. D. The formations of the Belly River of Canada.

Am. Naturalist, vol. 21, pp. 171-172. 1887.

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— The Mesozoic and Cenozoic realms of the interior of North America.

Am. Naturalist, vol. 21, pp. 445-462. 1887.

COPE, E. D.—Continued.

General review of the distribution, characteristics and equivalency of the several groups and their subdivisions and discussion of their paleontologic and stratigraphic relations. Reviews Gilbert on glacial age of the Montana equus beds.

— Mr. Hill on the Cretaceous of Texas.

Am. Naturalist, vol. 21, pp. 469-470. 1887.

Objects to the new nomenclature and discusses the probable equivalency of some of the groups and subdivisions.

[—?] [The International Congress of Geologists.]

Am. Naturalist, vol. 21, pp. 642-645. 1887.

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— Synopsis of the vertebrate fauna of the Puerco series.

Am. Phil. Soc., Trans., new series, vol. 16, pp. 298-361, pls. iv, v. 4°. 1888.

Prefatory remarks, *Am. Naturalist*, vol. 22, pp. 161-163. 1888.

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— Mesozoic realm.

International Congress of Geologists, *Am. Committee Report*, 1888, E, pp. 7-15.

Am. Geologist, vol. 2, pp. 261-268. 1888.

Résumé of distribution, general relations, and characteristics of the several formations, and discussions of age and equivalency.

— Report of the subcommittee on the Cenozoic (Interior).

International Congress of Geologists, *Am. Committee Reports*, 1888, G, p. 20.

Am. Geologist, vol. 2, pp. 285-299. 1888.

Résumé of paleontologic and geologic characteristics of the members of the Cenozoic, and a discussion of their age, range, and equivalency.

— Vertebrate fauna of the Puerco series. [Abstract.]

Science, vol. 11, p. 198, $\frac{1}{2}$ p. 1888.

Read to National Academy of Sciences.

Incidentally refers to position of Puerco beds.

— Sketches of the Cascade Mountains of Oregon.

Am. Naturalist, vol. 22, pp. 996-1005. 1888.

Scientific Am. Supt., vol. 27, pp. 10981-10982, (No. 687), 4°. 1889.

Includes sketches of volcanic history of the region and description of some geologic features in the vicinity of Crater Lake and in the cañon of the Des Chutes.

COPE, E. D.—Continued.

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Science, vol. 12, p. 290, $\frac{1}{2}$ col. 1889.

Discussion of the bearing of its mammalian remains.

— The vertebrate fauna of the Equus beds.

Am. Naturalist, vol. 23, pp. 161-165. (February number.) 1889.

List of species, description of new species from Washington, and brief discussion of age of Equus beds.

— An intermediate Pliocene fauna.

Am. Naturalist, vol. 23, pp. 253-254. 1889.

Notices of occurrence of mammalian remains from Oregon and discussion of their age; also refers to age of some Floridian remains.

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COSTE, E. [Preliminary report on sheet 113, Ontario.]

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COURTIS, W. M. The Animikie rocks and their vein phenomena as shown at Duncan Mine, Lake Superior.

Am. Inst. Mining Engineers, Trans., vol. 15, pp. 671-677, plate. 1887.

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COWLAM, George B. The extent and value of East Tennessee minerals.

Eng. and Mining Journ., vol. 45, pp. 19-21, 4°. 1888.

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 central Iowa, KEYES.
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- Kansas**, geology of, lecture, HAY.
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 CROSBY, W. O. Geology of the outer islands of Boston Harbor.

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Boston Soc. Nat. Hist., Proc., vol. 23, pp. 450-457. 1888.

Description of the relations of diabase sheets and dikes to slates, and discussion of structure, relations of the diabase, evidence of a fault, and cause of relative position and trend of the islands. Reference to drifts.

— **Geology of the Black Hills, Dakota.**

Boston Soc. Nat. Hist., Proc., vol. 23, pp. 488-517, vol. 24, p. 11, $\frac{1}{2}$ p. 1888.

Abstract, Am. Journ. Sci., 3d series, vol. 26, p. 153, $\frac{1}{2}$ p. 1888.

Sketch of geology and description of various features of the several formations. Discussion of relative ages of the crystalline rocks; the relation of the metamorphic conglomerate and the deformation of its pebbles; the correlations of the Archean rocks with those elsewhere; evidence of the existence of limestone in the Archean; origin, extent, relations, and age of the granites, volcanic rocks, mineral deposits, and superficial formations; conditions of deposition and formations in the West between the Cambrian and Carboniferous, relations of Paleozoic and Mesozoic; age, history, and relations of Black Hills uplift, and of the red beds and subsequent formations.

— **Quartzites and siliceous concretions.**

Sci. Am. Supt., vol. 26, pp. 10466-10468, folio, No. 655. 1888.

From Technology Quarterly.

Description of relations of Potsdam sediments in the Black Hills and discussion of the nature and origin of the included quartzite masses and on silicification in general.

— **and BARTON, G. H. On the great dikes at Paradise, near Newport.**

Boston Soc. Nat. Hist., Proc., vol. 23, pp. 325-330. 1887.

Gives an account of the geologic features of the region, the relations of which are found to be much simpler than formerly supposed; the "hornblende schist" of Dale proving on examination by Merrill to be an intrusive rock, probably an altered diorite.

CROSS, Whitman. Petrography.

Geology and Mining Industry of Leadville, Colorado, by S. F. Emmons, U. S. Geol. Survey, Mon., vol. 12, pp. 319-362, 2 plates. 1886.

Abstract, Am. Naturalist, vol. 22, p. 62, $\frac{1}{2}$ p. 1887.

Describes the eruptives of the Leadville region, and the Henry Mountain laccolites. Discusses age, succession, composition, and character of the rocks.

— **On the occurrence of topaz and garnet in lithophyses of rhyolite.**

Colorado Sci. Soc., Proc., vol. 2, part 2, pp. 61-70. 1887.

CROSS, Whitman—Continued.

Published in 1886, Am. Jour. Sci., 3d series, vol. 31, pp. 432-438.

— **The Cimarron landslide, July, 1886.**

Colorado Sci. Soc., Proc., vol. 2, part 2, pp. 116-128. 1887.

Describes geologic features of the vicinity and topographic changes due to the slide. Discusses its cause and similarity to other slides.

— **Note on phonolite from Colorado [El Paso County].**

Colorado Sci. Soc., Proc., vol. 2, pp. 167-170. 1888.

Abstract, Am. Naturalist, vol. 23, pp. 171-172, $\frac{1}{2}$ p. (February No.). 1889.

Petrographic description and analyses.

— **[Observations in regard to the paramorphic origin of certain minerals.]**

Colorado Sci. Soc., Proc., vol. 2, pp. 182-183. 1888.

Refers to instances observed in Custer County, Colorado.

— **On some eruptive rocks from Custer County, Colorado.**

Colorado Sci. Soc., Proc., vol. 2, pp. 228-250. 1888.

Abstract, Am. Naturalist, vol. 23, p. 171, $\frac{1}{2}$ p. (February No.). 1889.

Description of petrography and occurrence of rhyolites, trachytes, syenite, peridotite, augite-diorite, and sanadine-bearing andesite. Definition of lithologic terms.

— **The Denver Tertiary formation.**

Am. Jour. Sci., 3d series, vol. 37, pp. 261-279. 1889.

Abstract, Colorado Sci. Soc., Proc., vol. 3, pp. 119-133. 1889.

Description of distribution, stratigraphy, composition, and general relations of the formation, and discussion of stratigraphic and paleontologic evidence of its age and history.

CUMMINS, W. T. The Carboniferous of western Texas and its relation to the Cretaceous.

Am. Geologist, vol. 2, p. 138, $\frac{1}{4}$ p. 1888.

Reference to its barrenness in coal and to its conformable overlap by the Cretaceous.

— **Mining districts in El Paso County [Texas].**

Geol. and Sci. Bull., vol. 1, No. 2, $\frac{3}{4}$ col., 4^o. 1888.

Geologic relations of granites and porphyries to Cretaceous and Carboniferous limestones.

— **The Carboniferous formation in Texas.**

Geol. and Sci. Bull., vol. 1, No. 3, $1\frac{1}{2}$ col., 4^o. 1888.

CUMMINS, W. T.—Continued.

Reference to extent, relations, and stratigraphic range.

— Report of Geologist for northern Texas.

Texas, Geol. and Mineralogical Survey, First Report, 1888, pp. 45-53. 1889.

Abstract, Geol. and Sci. Bull., vol. 1, Nov., 1888, $\frac{1}{2}$ col.; Jan., 1889, $\frac{1}{2}$ col., 4^o.

Notes on Carboniferous coals and stratigraphy in northern central Texas.

CURTICE, Cooper. Oriskany drift near Washington, District of Columbia.**CURTICE, Cooper**—Continued.

Am. Geologist, vol. 3, pp. 223-225. 1889.

Calls attention to occurrence of fossiliferous pebbles in the Potomac formation at Mount Vernon and near Alexandria.

CUSHING, H. P. Notes on the Berea grit in northeastern Ohio.

Am. Assoc. Adv. Science, Proc., vol. 36, pp. 213-215. 1888.

Gives stratigraphic sections at several localities. Description of extent and relations and discussion of equivalency of the beds, especially of the sandstone north of Warren.

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Dakota School of Mines, Report on Black Hills.

Geology of the Black Hills, CARPENTER.

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DALL, William H. Notes on the geology of Florida.

Am. Jour. Sci., 3d series, vol. 34, pp. 161-170. 1887.

DALL, William H.—Continued.

Describes the extent of the several superficial and Tertiary formations and discusses their faunal distribution and equivalency, and the synchronism of post-Cretaceous formations in general. Calls attention to many rock outcrops and new fossiliferous localities, and to a series of meridional flexures crossing the Caloosahatchee River.

— [On the faunal relations of the formations of the Tertiary.]

International Congress of Geologists, Am. Committee Reports, 1888, F., p. 16, $\frac{1}{2}$ p.

Am. Geologist, vol. 2, p. 282. 1888.

Discussion of basis on which Tertiary should be subdivided.

DANA, Edward S. Contributions to the petrography of the Sandwich Islands.

Am. Jour. Sci., 3d series, vol. 37, pp. 441-467, pl. xiv. 1889.

Abstracts, Am. Naturalist, vol. 23, pp. 522-533, $\frac{1}{2}$ p. 1889. Nature, vol. 40, p. 189, 11 lines. 1889.

Petrographic descriptions of lavas. Includes an account of volcanic stalactites and discussion of their origin.

DANA, James D. Volcanic action.

Am. Jour. Sci., 3d series, vol. 33, pp. 102-115. 1887.

Discusses causes and results of volcanic action and a résumé and discussion of the phenomena of Kilauea, Vesuvius, the recent New Zealand eruptions, and other instances.

[—?] The origin of mountain ranges considered experimentally, structurally, dynamically, and in relation to their geological history, by T. Mellard Reade [etc.].

Am. Jour. Sci., 3d series, vol. 33, pp. 240-242. 1887.

DANA, James D.—Continued.

A brief statement of the theory and a review of its application to continental uplift and the Appalachian trough.

- On Taconic rocks and stratigraphy, with a geological map of the Taconic region; part 2, the middle and northern part.

Am. Jour. Sci., 3d series, vol. 33, pp. 270-276 392-419, pl. 11. 1887.

[Continued from vol. 29, p. 443, 1885.]

Describes the rocks and a series of sections across the region, and discusses the structural and stratigraphic relations, distribution, and equivalency of the limestones, schists, and quartzites. In a supplement entitled "The views of Prof. Emmons on the Taconic system," reviews Hunt's "The Taconic question restated," pp. 412-419.

- [—?] Report on the geology of New Jersey for 1886.

Am. Jour. Sci., 3d series, vol. 34, p. 71, § p. 1887.

Abstract of Britton's report on the Archean and discussion of the use of the term Huronian.

- [—] Geology of Long Island.

Am. Jour. Sci., 3d series, vol. 34, pp. 153-155. 1887.

Abstract and review of F. J. H. Merrill's paper described in the bibliography for 1886. Discusses the character of the drift ridges, the identification of the Cretaceous and Tertiary, the uplift of the preglacial formations by the advancing edge of the ice sheet, and the cause of the deep bays in the north shore of the island.

- [—?] A pot-hole of remarkable size in Archbald, Pennsylvania.

Am. Jour. Sci., 3d series, vol. 34, p. 489. 1887.

Description, and discussion of its origin.

- History of the changes in the Mount Loa craters; part I, Kilauea.

Am. Jour. Sci., 3d series, vol. 35, pp. 15-34, pp. 213-228, 282-289, pls. I, IV, V. 1888.

Abstract, *Nature*, vol. 37, p. 358, 17 lines. 1888.

Includes discussion of the causes and relations of the changes, the mobility of the lavas, the eruptive and crater characteristics of a basalt volcano, size of the Kilauea conduit, and the conditions involved in the various phenomena occurring between the eruptions.

- [—] Gradual variation in intensity of metamorphism.

Am. Jour. Sci., 3d series, vol. 35, pp. 82-83, § p. 1888.

Refers to illustrative localities west of New Haven, and discusses the occurrence and ori-

DANA, James D.—Continued.

gin of included masses of granite in that region.

- [—] Fossils of Littleton, New Hampshire.

Am. Jour. Sci., 3d series, vol. 35, p. 255, § p. 1888.

Notice of their reference to the Niagara group by Hitchcock in 1884.

- History of changes in the Mount Loa craters, part III, eruptives of Kilauea and Mount Loa.

Am. Jour. Sci., 3d series, vol. 36, pp. 90-112, 167, 175. 1888.

Discussion of the characteristics and causes of eruption, metamorphism as an effect of volcanic conditions, the origin of the form of Mount Loa, relations of Kilauea to Mount Loa, and the contrast between volcanoes of the Mount Loa and Vesuvius types.

- History of the changes in the Mount Loa craters, part II, Mokuaweoweo.

Am. Jour. Sci., 3d series, vol. 36, pp. 14-32, pl. 1, 81-90. 1888.

History of eruptions, etc., and discussion of times and time intervals, and the nature and causes of the ordinary activity within the summit crater.

- Brief history of Taconic ideas.

Am. Jour. Sci., 3d series, vol. 36, pp. 410-427. 1888.

And résumé of present knowledge of the relations in the Taconic region.

- [On the use of the term "Taconic."]

International Congress of Geologists, *Am. Committee Reports*, 1888, B, pp. 8-9.

Am. Geologist, vol. 2, pp. 198-199. 1888.

Discussion, of its applicability to lower Paleozoic formations.

- [On the subdivisions, nomenclature, distinctive features, and origin of some members of the Archean, origin of Serpentine, and the use of terms "Taconic," "Ordovician," and "Cambrian."]

International Congress of Geologists, *Am. Committee Reports*, 1888, A, pp. 53-55.

- Recent observations of Mr. Frank S. Dodge, of the Hawaiian Government Survey, on Halema'uma'u and its debris cone.

Am. Jour. Sci., 3d series, vol. 37, pp. 48-50. 1889.

Evidence of recent elevation of the cone and some other minor changes in the crater.

- Points in the geological history of the islands Maui and Oahu.

DANA, James D.—Continued.

Am. Jour. Sci., 3d series, vol. 37, pp. 81-103, pls. III, IV. 1889.

Description and discussion of topographic and geologic relations, discussion of geologic history, volcanism and evidence of subsidence. Statement of opinion in regard to Darwin's theory of coral island formation.

— On the origin of the deep troughs of the Oceanic depression. Are any of volcanic origin?

Am. Jour. Sci., 3d series, vol. 37, pp. 192-202, pl. VII. 1889.

Review of distribution and relations of the deep Oceanic troughs. Accompanied by a bathymetric map.

— The name Silurian in geology.

Popular Science Monthly, vol. 36, p. 276, ½ p. 1889.

Discussion of nomenclature of the Silurian and Ordovician, and suggestion of term "Ordovician" for the "upper Silurian."

DARTON, Nelson H. Bibliography of North American geology for 1886.

U. S. Geol. Survey, Bull., vol. 7, pp. 343-377, No. 44. 1887.

— On the great lava flows and intrusive trap-sheets of the Newark system in New Jersey.

Am. Jour. Sci., 3d series, vol. 30, pp. 134-139. 1889.

Discussion of characteristics of extrusive and intrusive masses, and an account of the nature and relations of the traps of the New Jersey region.

— North American geology for 1886.

Smithsonian Institution, Report, 1886-'87, Part 1, pp. 189-229. 1889.

(Classified abstracts of papers.)

DARWIN, Charles. The structure and distribution of coral reefs, 3d edition, with an appendix by T. G. Bonney, p. 344. New York. 1889.

Davenport Academy of Natural Sciences, Proceedings, vol. 5, part 1.

A defense of our local geology, BARRIS.

Rockford shales of Iowa, WEBSTER.

DAVIS, Charles H. S. The *Catopterus gracilis*.

Meriden Sci. Assoc., Trans., vol. 2, pp. 19-22. 1887.

Remarks on the occurrence of fish remains in the Trias, and a description of the locality at Little Falls, Connecticut.

DAVIS, William Morris. Instruction in geological investigation.

DAVIS, William Morris—Continued.

Am. Naturalist, vol. 21, pp. 810-825. 1887.

In discussing some experiences with his field classes, describes dike contacts in the quarry at Somerville, Massachusetts, and evidences of a former higher level of the sea about Boston.

— [Results of a study of the mechanical origin of the Triassic monoclinical in the Connecticut valley.]

Boston Soc. Nat. Hist., Proc., vol. 23, pp. 339-341. 1887.

Reviews the various theories and advances a hypothesis to account for the monoclinical attitude. This paper antedates the one on the same subject described in the 1886 bibliography.

[—] The origin of mountain ranges, considered experimentally, structurally, dynamically, and in relation to their geological history. By T. Mel-lard Reade. London.

Science, vol. 10, p. 139. 1887.

States condition of present opinions on the subject, and briefly relates and reviews the author's theory.

— The classification of lakes.

Science, vol. 10, pp. 142-143. 1887.

Discusses the formation of lakes in the development of drainage systems, and the effects of lava flows and glacial incursions.

— The ash bed at Meriden and its structural relations.

Meriden Sci. Assoc., Trans., vol. 3, pp. 23-30. 1888.

Brief notice of the occurrence of the ash-bed; description of contacts of trap with overlying sediments in Lamentation Mountain and of West Rock range, New Haven, and the structural relations in the Meriden region, and sketch of the history of volcanic extrusion, and the mechanism of the uplift and faulting of the Newark formation of the Connecticut valley.

[—] Geographic methods in geologic investigation.

National Geogr. Mag., vol. 1, pp. 11-26. 1888.

Discussion of the status of geographic science and the genetic relations of topographic features. Includes references to structure of the Newark formation of the Connecticut valley, base levels in New Jersey and in eastern Pennsylvania, the relations of topography and drainage to structure and uplift in the Appalachian region and elsewhere, and conditions affecting waterfalls, instanced by some in northeastern Pennsylvania.

DAVIS, William Morris—Continued.

[—] The topographic map of New Jersey.

Science, vol. 12, pp. 206-207. 1888.

Calls attention to topographic features expressing geologic relations or suggesting geologic problems: Submerged mouths of streams along coast, course and termination of ridges in the Newark region, fracture separating Archean highlands from lowlands of softer sediments, and some relations of the preglacial Passaic drainage.

— The structure of the Triassic formation of the Connecticut valley.

U. S. Geol. Survey, Seventh Report, J. W. Powell, 1885-'86, pp. 455-490, pl. 52. 1887.

Abstract, *Am. Geologist*, vol. 4, pp. 112-113. 1889.

Description and discussion of stratigraphy and the structural relations and characteristics of the igneous members, and a discussion of the mechanical origin of the Triassic monocline, with its faults and flexures.

— The faults in the Triassic formation near Meriden, Connecticut.

Harvard College, Mus. Comp. Zool. Bull., vol. 16, pp. 61-87, pls. 1-5. 1889.

Detailed description of the relations of traps and sandstones, and structural relations in the Meriden-New Britain region. Illustrated by sketch maps and cross-sections.

— Topographic development of the Triassic formation of the Connecticut valley.

Am. Jour. Sci., 3d series, vol. 37, pp. 423-434. 1889.

Abstract, *Popular Science Monthly*, vol. 36, p. 573, § col. 1890.

Description of structural features in the Meriden region, discussion of the cause and significance of the eastward deflection of the lower Connecticut, and the orographic relations and topographic history of the Connecticut valley region, and comparison of some of its stages with topography of fault systems in the Great Basin and in China.

— The glacial origin of cliffs.

Am. Geologist, vol. 3, pp. 14-18. 1889.

Discussion of the relations of cliff and talus slopes and their modification by glaciation, instancing those of the Newark regions of New Jersey and the Connecticut valley.

— Methods and models in geographic teaching.

Am. Naturalist, vol. 23, pp. 566-583. 1889.

Abstract, *Johns Hopkins Univ., Circulars*, vol. 8, p. 62, § p. 4^o. 1889.

Includes a general discussion of various types and stages of topographic development.

[—] A river pirate.

DAVIS, William Morris—Continued.

Science, vol. 13, pp. 108-109. 1889.

Describes the topographic relations of some drainage features in the southeastern corner of Pennsylvania and discusses their history.

[—] The ice age in North America and its bearing upon the antiquity of man.

[By G. F. Wright.]

Science, vol. 14, pp. 118-119. 1889.

A general review of the work.

— The contoured map of Massachusetts.

Science, vol. 14, pp. 422-423, § p. 1889.

A general review of the more characteristic topographic features of the State and some suggestions in regard to their geologic history.

— The rivers and valleys of Pennsylvania.

National Geogr. Mag., vol. 1, pp. 183-253. 1889.

Abstract, *Am. Geologist*, vol. 5, pp. 60-61, § p. 1891.

General description of salient topographic and geologic features, sketch of geologic history, exposition of conceptions of stages of development of drainage systems in general, and discussion of the genesis, history, and relations of the drainage of Pennsylvania.

— and WHITTLE, Charles Livy. The intrusive and extrusive Triassic trap sheets of the Connecticut valley.

Harvard College, Mus. Comp. Zool., Bull., vol. 16, pp. 99-138, pl. 5. 1889.

Abstract, *Am. Naturalist*, vol. 24, p. 769, 6 lines. 1890.

An account of the general features of intrusive and extrusive sheets in Connecticut and the palisade sheet in New Jersey, and detailed description of the more important localities. Illustrated by maps and sections.

DAWSON, George M. Report on a geological examination of the northern part of Vancouver Island and adjacent coasts.

Canada, Geol. and Nat. Hist. Survey, Report, 1886, part B, pp. 1-107, plates. 1887. Map No. 1 in atlas.

Abstract, *Geol. Magazine*, III, vol. 6, pp. 130-133. 1889.

Description of Cretaceous, Triassic, volcanics, granites, and drifts, and discussion of their distribution, relations, equivalency, geologic history, the contact relations of the granites and the existence of Carboniferous and Permian. Accompanied by a colored geologic map.

— Notes to accompany a geological map of the northern portion of the Dominion of Canada east of the Rocky Mountains.

DAVIS, William Morris—Continued.

Canada, Geol. and Nat. Hist. Survey, Report, 1886, part R, pp. 62, colored map. 1887.

Abstract, Geol. Magazine, III, vol. 6, pp. 137-138. 1889.

Includes a discussion of the characteristics, equivalency, age, range, structure, distribution, and relations of the various formations and areas, and of the direction of ice movement in the glacial period.

- On the Canadian Rocky Mountains, with special reference to that part of the Range between the 49th parallel and the headwaters of the Red Deer River.

Canadian Record of Science, vol. 2, pp. 586-300. 1887.

Abstract, without geology, British Assoc. Adv. Sci., Report of the 56th meeting, 1886, pp. 638-639.

General sketch of topographic and geologic features, constituting an abstract of his paper in the Canadian Geol. Survey Report, vol. 1, new series, and described in the 1886 bibliography.

- On certain borings in Manitoba and the Northwest Territory.

Canada, Royal Soc., Trans., vol. 4, Section IV, pp. 85-99. 1887.

Abstract, Geol. Magazine, 3d decade, vol. 4, pp. 278-289. 1887.

Description of beds passed through at Rosenfield Station, Rat Creek, Sologirth, Grenfel Station, McLean Station, Regina, Belle Plain Station, Langevin Station, Cassilla, and Gleishen Station, and discussion of the equivalency of some of the strata, the thinning of some of the Paleozoic formations toward the region, the relation of the drift deposits, and the stratigraphy of the Cretaceous at the Langevin hole.

- Note on the Cascade Anthracite basin, Rocky Mountains.

Am. Geologist, vol. 1, pp. 332-333. 1888.

General description of the trough and reference to the horizon and thickness of the Cretaceous in that region.

- The geological observations of the Yukon expedition, 1887.

Science, vol. 11, pp. 185-186. 1888.

Description of the geology of the Coast Range and of the region eastward, to, and including the Rocky Mountains, in west central British Columbia. Includes references to rock series from granites to Miocene, relations of superficial deposits and evidence of glacial action, terraces, striation, and great volcanic ash deposit.

- Recent observations on the glaciation of British Columbia and adjacent regions.

DAVIS, William Morris—Continued.

Geol. Magazine, 3d decade, vol. 5, pp. 347-350. 1888.

Am. Geologist, vol. 3, pp. 279-283. 1889.

Describes and discusses evidence bearing on the extent and directions of movements of the great ice mass. Includes a brief reference to the occurrence of boulder clay deposits and to the general terracing of the region.

- Notes on the ore deposit of the Treadwell mine, Alaska.

Am. Geologist, vol. 4, pp. 84-83. 1889.

Discussion of geneals and geologic relations.

- On the earlier Cretaceous rocks of the northwestern portion of the Dominion of Canada.

Am. Jour. Sci., 3d series, vol. 38, pp. 120-127. 1889.

Abstract, Nature, vol. 40, p. 404, 11 lines. 1889. Am. Naturalist, vol. 24, p. 769, 1 p. 1890.

Discusses correlation, extent, and geologic history of Kootanie, Queen Charlotte, and other earlier Cretaceous formations in western Canada, relations of overlying conglomeritic series, and Canadian equivalents of the Comanche formation of the Texas region.

- Glaciation of high points in the southern interior of British Columbia.

Geol. Magazine, decade III, vol. 6, pp. 350-352. 1889.

Abstracts, Ottawa Naturalist, vol. 3, pp. 112-113, 1 p. 1889. Am. Naturalist, vol. 24, p. 771, 4 lines, 1890.

List of some glaciated high summits and remarks on their bearing on the conditions of the glaciation of the region.

- On the Archean, see **FRAZER**. Report on Archean.

- See, also, Dawson, J. W., and Dawson, G. M., on Cretaceous plants from Port McNeill, Vancouver Island.

DAWSON, J. William. On the correlation of the geological structure of the Maritime Provinces of Canada with that of western Europe. (Abstract.)

Canadian Record of Science, vol. 2, pp. 404-406. 1887.

Science, vol. 9, pp. 589-590. 1887.

Discusses the differences between the formations of eastern Canada and those farther west, and points out their close similarity to the formations of western Europe.

- Notes on fossil woods from the western territories of Canada.

Canadian Record of Science, vol. 2, pp. 499-502. 1887.

Nature, vol. 36, pp. 274-275. 1887.

DAWSON, J. William—Continued.

Discusses the age of the Laramie group and questions of climate and contemporaneity of the lower Eocene flora of different regions.

— On the relation of the geology of the Arctic and Atlantic basins.

British Assoc. Adv. Science, Report of Fifty-sixth Meeting, 1886, p. 638, $\frac{1}{2}$ p. 1887.

Points out the intimate relations of the Arctic formations to those of eastern North America.

— Some points in which American geological science is indebted to Canada.

Canada, Royal Soc., Trans., vol. 4, section iv, pp. 1-8. 4°. 1887.

Résumé of the history of geologic research in Canada, especially by Logan. Briefly discusses the subdivisions of the pre-Cambrian of Canada; the relations and equivalency of the "Quebec" group, the position of the "so-called Jurassic of the western territories of the United States," and continental glaciation.

— On the fossil plants of the Laramie formation of Canada.

Canada, Royal Soc., Trans., vol. 4, section iv, pp. 19-34, pls. 1-2, 4°. 1887.

Describes the extent and stratigraphy of the formation and discusses its equivalency and floral relations.

— Cretaceous floras of the northwest territories of Canada.

Am. Naturalist, vol. 22, pp. 953-959. 1888.

Abstract of paper read to Royal Society of Canada. 1888.

Discussion of stratigraphic positions, the value of fossil plants in indicating geologic horizons, and the physical conditions and climate indicated by the faunas.

— Preliminary note on new species of sponges from the Quebec group at Little Metis.

Canadian Record of Science, vol. 3, pp. 49, 59, plate. 1888.

Discussion of the geologic horizon of the beds.

— Eozoon canadense.

Canadian Record of Science, vol. 3, pp. 201-226. 1888.

Extracts from publications of the Peter Redpath Museum, September, 1888.

In part as "On new facts relating to Eozoon canadense," Geol. Magazine, decade 3, vol. 5, pp. 49-54, plate. 1888.

Review of paragraph 9, on upper Laurentian, by A. R. C. Selwyn, Science, vol. 11, p. 146, $\frac{1}{2}$ col. 1888.

Includes incidental references to containing beds at several localities, beds of fragmental Eozoon, the relations of the limestones of the

DAVIS, William Morris—Continued.

middle Laurentian, the aqueous origin of the greater part of the upper Laurentian, the equivalency of some of the crystalline rocks west of Lake Superior with the upper Laurentian of St. Jerome, and some instances of rock lamination.

— Notes on fossil woods and other plant remains from the Cretaceous and Laramie formations of the western territories of Canada.

Canada, Royal Soc., Trans., vol. 5, section iv, pp. 31-37, 4°. 1888.

Abstract, Am. Geologist, vol. 1, pp. 195-197. 1888.

Includes references to localities, climatic conditions in later Cretaceous and early Tertiary times, the position of the Laramie of the Northwest, and the distinction between the lower and upper Laramie.

— On the Eozoic and Paleozoic rocks of the Atlantic coast of Canada in comparison with those of western Europe and the interior of America.

Geol. Soc., Quart. Jour., vol. 44, pp. 797-817. 1888.

Abstracts, Geol. Magazine, 8d decade, vol. 5, pp. 331-332, 1888; Canadian Record Science, vol. 3, pp. 182-183, 230-231, 1888; Nature, vol. 38, p. 142, $\frac{1}{2}$ col., 1888; Popular Science Monthly, vol. 34, p. 287, $\frac{1}{2}$ p., 1889.

Subdivisions, relations, history, extent, and equivalency of Laurentian, Huronian, Cambrian, Ordovician, Silurian, Devonian, and Carboniferous systems.

— [On nomenclature, subdivisions, characteristics, evidence of life and origin of some members of the Archean, origin of serpentines, classification of Archean eruptives, nomenclature of lower Paleozoic.]

International Congress of Geologists, Am. Committee Reports, 1888, A, p. 71, $\frac{1}{2}$ p.

— [On use of term "Taconic."]

International Congress of Geologists, Am. Committee Reports, 1888, B, p. 17, 1 line.

Am. Geologist, vol. 2, p. 207.

Expression of opinion.

— On Nematophyton and allied forms from the Devonian (Erian) of Gaspé and Bay des Chaleurs. Introductory geological note.

Canada, Royal Soc., Trans., vol. 6, Section iv, pp. 27-36. 1889.

Includes a sketch of the stratigraphy of the region and table showing the equivalency of the Devonian beds with those of other localities.

DAWSON, J. William—Continued.

— Supplemental note to a paper on the rocks of the Atlantic coast of Canada.

Geol. Soc., Quart. Jour., vol. 45, p. 80, $\frac{1}{2}$ p. 1889.

Reference to the position of the *Olenellus* fauna and to the bearing of new evidence on this point on the geologic conditions during Lower Cambrian and late pre-Cambrian times.

— Note on *Balanus Hameri* in the Pleistocene at Rivière Beaudette, and on the occurrence of peculiar varieties of *Mya arenaria* and *M. truncata* in the modern sea and in the Pleistocene.

Canadian Record Science, vol. 3, pp. 287-292. 1889.

Brief reference to nature and equivalency of the containing beds.

— Handbook of geology for the use of Canadian students, p. 250, Montreal. 1889.

— and **DAWSON, G. M.** On Cretaceous plants from Port McNeill, Vancouver Island.

Canada, Royal Soc., Trans., vol. 6, Section IV, pp. 71-72.

Abstract, Canadian Record of Science, vol. 3, p. 167, $\frac{1}{2}$ p. 1888.

Includes a description of the relations of the plant-bearing beds and statement in regard to their equivalency and age.

[DAY, David T.] Infusorial earth.

U. S. Geol. Survey, Mining Resources, 1887, p. 554, $\frac{1}{2}$ p. 1888.

Notice of occurrence at Pope's Creek, Maryland, and Linkville, Klamath County, Oregon. Analyses of former by P. de P. Ricketts.

Delaware, Sand dunes of Lewes, ROTHROCK.

DEMING, J. L. See **HERRICK, C. L.** and **CLARKE, E. S.**

Denison University, Scientific Laboratories, Bulletin, vol. 2.

Clinton group of Ohio, **FOERSTE.**

Geological history of Licking County, **HERRICK.**

Geology of Michipicition Bay, **HERRICK, TIGHT and JONES.**

— vol. 3.

Clinton group of Ohio, **FOERSTE.**

Geology of Licking County, Ohio, **HERRICK.**

— vol. 4.

Geology of Licking County, **HERRICK.**

Bull. 75—5

Denison University, Scientific Laboratories, Bulletin, vol. 4—Continued.

Contact phenomena in South Carolina, **RICHARDS.**

DENNIS, D. W. The east-west diameter of the Silurian island about Cincinnati.

Am. Naturalist, vol. 22, p. 94, 8 lines. 1888.

Abstract of paper read to Indiana Academy of Science.

Reference to occurrence of beds indicating position of shore line.

Deutsche Geologische Gesellschaft, Zeitschrift, vol. 40.

Jorullo in Mexico, **FELIX.**

DERBY, Orville A. On the occurrence of monazite as an accessory element in rocks.

Am. Jour. Sci., 3d series, vol. 37, pp. 109-113. 1889.

Announcement of discovery of monazite and zircon as constituents of various granite rocks in Brazil.

Devonian.

Alabama, **SPENCER, J. W.**

Canada, At-ta-wa-pish-kat and Albany rivers, **BELL.**

Baffin Land, **BOAS.**

Eozoic and Paleozoic of Canada, **DAWSON, J. W.**

explorations in portions of New Brunswick, **BAILEY and MCINNES.**

gypsum in northern Manitoba, **TYRRELL.**

natural gas in Quebec, **LAFLAMME.**

Nematophyton from Gaspé, **DAWSON, J. W.**

northern Maine and New Brunswick, **BAILEY.**

northern part of the Dominion of Canada, **DAWSON, G. M.**

Nova Scotia, faults and foldings in Pictou coal field, **GILPIN.**

Nova Scotia, Guysborough, Antigonish, and Pictou, **FLETCHER.**

Ontario iron ores, **IVES.**

Ontario petroleum field, **BELL.**

Ontario, range of Hamilton fossils, **CALVIN.**

organisms in southern New Brunswick, **MATTHEW.**

Passamaquoddy Bay region, **MATTHEW.**

Red River Valley, Manitoba, **MCCHARLE.**

Devonian—Continued.*Canada—Continued.*

relations between geology of Maine and New Brunswick, BAILEY.

Rocky Mountains near the 51st parallel, McCONNELL.

well at Port Colborne, McRAE.

Georgia, SPENCER, J. W.

Indiana, GORLEY. THOMPSON, M.

Iowa, Devonian fauna, WILLIAMS, H. S.

general description, WEBSTER.

Johnson County, WEBSTER.

Muscatine County, CALVIN.

Rockford shales, WEBSTER.

southeastern Iowa, GORDON.

well at Keokuk, GORDON.

well at Davenport, TIFFANY.

well at Washington, CALVIN.

Kansas, Leavenworth well, JAMESON.

Kentucky, Bath and Fleming counties, LINNEY.

Clarke, Lincoln, Mercer, LINNEY.

central Kentucky, LINNEY.

Garrard County, LINNEY.

Henry, Selby, and Oldham counties, LINNEY.

Jackson purchase region, LOUGHRIDGE.

Marion County, KNOTT.

Nelson County, LINNEY.

Oriskany of eastern, PROCTOR.

Ohio Valley, SHALER.

Pound Gap region, CRANDALL.

rocks of central Kentucky, LINNEY.

Maine, Aroostook County, BAILEY.

Eastport, SHALER.

northern Maine, BAILEY.

Minnesota, natural gas wells, WINCHELL, N. H.

maps, UPHAM.

artesian wells, HALL, C. W.

Missouri, Chouteau group, ROWLEY.

history of Ozark uplift, BROADHEAD.

Macon County, MCGEE.

Montana, Gallatin region, HAYDEN. WALCOTT.

Nebraska, well at Lincoln, RUSSELL, J. W.

well in Pawnee County, RUSSELL, J. W.

New Jersey, Green Pond Mountain group, MERRILL, F. J. H.

geologic map, COOK.

map of vicinity of New York city, MARTIN.

New York, building stones, SMOCK.

Devonian—Continued.*New York—Continued.*

fauna of upper Devonian; Genesee section, WILLIAMS, H. S.

Hamilton of Chenango and Otsego counties, PROSSER.

Oneonta sandstone, BEECHER and HALL, J.

petroleum and gas regions, ASHBURNER.

Tully limestone, WILLIAMS, S. G.

well at Morrisville, PROSSER.

Williams's report on Devonian, MARCOU.

Nomenclature and classification, report of subcommittee on upper Paleozoic, International Congress of Geologists, WILLIAMS, H. S.

plants of the Paleozoic, LESQUERREUX.

Williams's report on Devonian, MARCOU.

comparison of cis- with trans-Atlantic formations, WINCHELL; H. S.

types of Devonian system in North America, WILLIAMS, H. S.

Ohio, geology of Ohio, ORTON.

Licking County, HERRICK.

plants, NEWBERRY.

report on oil and gas, ORTON.

sporocarps in Ohio slate, ORTON.

Waverly group, HERRICK.

Pennsylvania, Cambria County, FULTON.

four great sandstones, CLAYPOLE.

Lehigh River cross section, HILL, F. A. WINSLOW.

materials of the Appalachians, CLAYPOLE.

northern, WILLIAMS, H. S.

oil and gas regions, CARLL.

paint ores along Lehigh River, HILL, F. A.

Virginias, Greenbrier County, PAGE.

Low Moor, LYMAN.

mineral resources of Tennessee, PAGE.

New River-Cripple Creek region, D'INVILLIERS and MCCREATH.

southwestern Virginia, STEVENSON.

DEWEY, Fred. P. Note on the nickel ore of Russell Springs, Logan County, Kansas.

Am. Inst. Mining Engineers, Trans., vol. 17, pp. 636-637. 1889.

Includes brief reference to geologic relations of beds in which it occurs.

DILLER, J. S. Notes on the geology of northern California (abstract).

Washington, Phil. Soc., Bull., vol. 9, pp. 4-5 (additional note on p. 8). 1887.

Am. Jour. Sci., 3d series, vol. 33, pp. 152-153. 1887.

Am. Geologist, vol. 1, pp. 125-126, $\frac{1}{2}$ p. 1888.
Popular Science Monthly, vol. 32, p. 419. 10 lines. 1888.

Abstract of U. S. Geol. Survey, Bulletin No. 33, described in the 1886 bibliography.

— The latest volcanic eruption in northern California and its peculiar lava.

Am. Jour. Sci., 3d series, vol. 33, pp. 45-50. 1887.

Abstract, Am. Geologist, vol. 1, p. 126, $\frac{1}{2}$ p. 1888.

Describes beds of volcanic ash, in places inclosing the stumps of more or less decayed trees, and in part overlain by a peculiar "quartz basalt," the nature, origin, and occurrence of which is discussed at length.

— Peridotite of Elliott County, Kentucky.

U. S. Geol. Survey, Bull., vol. 6, pp. 357-385, No. 38. 1887.

Abstracts, Am. Geologist, vol. 1, p. 125, $\frac{1}{2}$ p. 1888. Popular Science Monthly, vol. 32, p. 420, $\frac{1}{2}$ col. 1888.

(By Geo. H. Williams), Neues Jahrbuch, 1887, vol. 2, pp. 475-476.

Describes its occurrence, micro-petrography, structure, and alteration. Discusses its nature, origin, and relations to the associated Carboniferous sandstones. Quotes Crandall's description of the region.

— Supplementary note on the peridotite of Elliott County, Kentucky.

Am. Jour. Sci., 3d series, vol. 37, pp. 219-220. 1889.

Entirely petrographic.

— [Report on petrography of peridotite from Douglas County, Oregon, and Webster, North Carolina.] See **CLARKE, F. W.**, on nickel ores from Oregon.

— and **KUNZ, George F.** Is there a diamond field in Kentucky?

Science, vol. 10, pp. 140-142. 1887.

Describe and figure the peridotite outcrops, call attention to an exposure of contact with the Carboniferous shales, and discuss the possibilities of the occurrence of diamonds.

DODGE, James A. Anthracite coal in the valley of the Bow River, Northwest Territory of Canada.

DODGE, James A.—Continued.

Am. Geologist, vol. 1, pp. 172-173. 1888.

Analyses and letter from A. Pugh on number of beds and dip.

DRUMMOND, A. T. The distribution and physical and past geological relations of British North American plants.

Canadian Record of Science, vol. 2, pp. 412-423, 457-469. 1887. Vol. 3, pp. 1-21. 1888.

Discusses probability of a Tertiary land connection between Asia and North America, and post-Tertiary changes in North American physiography which would impede the eastward extension of plants. Advances botanical evidence in opposition to the idea of regional glaciation in Canada, and argues in favor of local glaciation. Incidentally refers to climatic conditions in later Cretaceous and Eocene times indicated by the flora.

— The prairies of Manitoba.

Canadian Record Science, vol. 3, pp. 39-43. 1888.

Description of superficial deposits and discussion of the origin of the prairies.

— The great lake basins of Canada.

Canadian Record Science, vol. 3, pp. 142-147. 1888.

Abstract, Popular Science Monthly, vol. 35, pp. 422-423, $\frac{1}{2}$ p. 1889.

Objections to the theory of continental glaciation in America. Discussion of origin of the basins and the relations of land and water in northern North America during the glacial epochs.

— The great lake basins of the St. Lawrence.

Canadian Record Science, vol. 3, pp. 247-287. 1889.

Abstracts, Science, vol. 13, p. 32, $\frac{1}{2}$ col. 1889. Am. Geologist, vol. 3, pp. 197-199, $\frac{1}{2}$ p. 8. 1889.

A discussion of their origin, history, associated superficial deposits, relations to geologic structure of the region and conditions during glacial period.

DUMBLE, E. T. The Nacogdoches oil field.

Geol. and Sci. Bull., vol. 1, March, 1888, $\frac{1}{2}$ col.

References to the lower Eocene horizon of the oil-bearing beds.

DUNN, Russell L. Drift mining in California.

California, Eighth Report of State Mineralogist, pp. 736-770. 1888.

Includes references to the ancient drainage systems to which the gold-bearing gravels belong. Discusses relations, sequence, and extent of some of the lava flows by which this drainage system was displaced.

DUTTON, Clarence E. Mount Taylor and the Zuñi Plateau.

U. S. Geol. Survey, Sixth Report, J. W. Powell, 1884-'85, pp. 106-198, pls. 11-22. 1885.

Abstracts, *Am. Jour. Sci.*, 3d series, vol. 34, pp. 155-198, pls. 11-12; *Science*, vol. 10, pp. 317-318. 1887.

Describes the High Plateau country as a whole, the formations of northwestern New Mexico, extending from upper Carboniferous to Wahsatch sandstone, the uplift or "swell" of the Zuñi Plateau, the Zuñi uplift, Mount Taylor and vicinity with its great middle Tertiary lava flows and old vents, the newer lavas of the San José valley region and their source, and the areal geologic features in general. Discusses questions of synchronism and stratigraphy, especially in regard to the Jura and Trias, the mechanism of the faults on the southwest side of the Zuñi Plateau, the relations of the Archean to the adjacent Carboniferous rocks along the axis of the Zuñi Plateau, and the age, extent, and mode of extrusion of the lavas of Mount Taylor and vicinity, and of the more recent flows. Chapter v consists of a general discussion of the geologic history of the High Plateau and adjoining regions.

— The submerged trees of the Columbia River.

Science, vol. 9, pp. 82-84. 1887.

Describes evidence of a slight post-glacial transverse anticlinal as the cause of damming.

— [On geologic nomenclature in general, and the classification, nomenclature, and distinctive characteristics of the pre-Cambrian formations, and the origin of serpentines.]

International Congress of Geologists, Am. Committee Reports, 1888, A, pp. 71-73.

[—] [On the use of the term Taconic.]

International Congress of Geologists, Am. Committee Reports, 1888, B, p. 17, 1 line.
Am. Geologist, vol. 2, p. 207. 1888.
Statement of opinion.

— Report—Division of volcanic geology.

U. S. Geol. Survey, Seventh Report, J. W. Powell, 1885-'86, pp. 97-103. 1888.

Includes a general description of the geology of the region between the Cascade Ranges and the Sierra Nevada, the southern part of the Cascade Ranges, and the region westward, including the Coast Ranges in western Oregon and northwestern California.

— On some of the greater problems of physical geology.

Washington Phil. Soc., *Bull.*, vol. 11, pp. 51-64. 1889.

DUTTON, Clarence E.—Continued.

Discussion of earth crust deformation.

DWIGHT, William B. Palæontological observations on the Taconic limestones of Canaan, Columbia County, New York. (Abstract.)

American Naturalist, vol. 21, pp. 270-271. 1887.

Describes Trenton and Calceiferous fossiliferous limestone exposures.

— Primordial rocks of the Wappinger Valley limestones.

Vassar Brothers' Inst., *Trans.*, vol. 4, pp. 130-141, Pl. 1. 1887.

Republication of a paper entitled "Discovery of fossiliferous Potsdam strata at Poughkeepsie, New York," in *Am. Jour. Sci.*, 3d series, vol. 31, pp. 125-133, pl. 6, and described in the bibliography for 1886.

— Primordial rocks of the Wappinger Valley limestones and associated strata.

Vassar Brothers' Inst., *Trans.*, vol. 4, pp. 206-214. 1887. See, also, *Am. Jour. Sci.*, 3d series, vol. 34, pp. 27-32. 1887.

Calls attention to several new localities of fossiliferous Potsdam and discusses the relations of the several belts of this formation to each other and to the associated limestones. Announces the discovery by himself and Walcott of middle Cambrian remains in the quartzites and limestone on the flanks of Stissing Mountain and its vicinity, and describes the structure of the region. Gives a general résumé of the formations occurring in Dutchess County, New York.

— [Remarks on crustal plication in continental elevation.]

Vassar Brothers' Inst., *Trans.*, vol. 4, pp. 271-273. 1887.

Discusses Warring's address on the evolution of continents.

— Recent explorations in the Wappinger Valley limestone of Dutchess County, New York. No. 6. Discovery of additional fossiliferous Potsdam strata and pre-Potsdam strata of the *Olenellus* group, near Poughkeepsie, New York.

Am. Jour. Sci., 3d series, vol. 34, pp. 27-32. 1887.

Essentially similar to "Primordial rocks of the Wappinger Valley limestones and associated strata," which antedates it.

— Recent explorations in the Wappinger Valley limestones and other formations of Dutchess County, New York. No. 7. Fossiliferous strata of the paradoxis zone at Stissing. No. 8. Dis-

DWIGHT, William B.—Continued.
covery of Calciferous fossils in the Millerton-Fishkill limestone belt; also in a belt near Rhinebeck.

Am. Jour. Sci., 3d series, vol. 38, pp. 139-153, pl. 6. 1889.

No. 7. Description of relations of Olenellus-

DWIGHT, William B.—Continued.

Ordovician in the vicinity of Stissing Mountain and Pine Plains. Descriptions of fossils.

No. 8. Announcement of discovery of fossils and brief discussion of relations of limestones and schists in the vicinity of Millerton; also announces fossils from near Rhinebeck.

E.

Edinburgh Geological Society, Transactions, vol. 5.

Canadian and Scottish glacial geology, RICHARDSON.

Geology of Winnipeg district, MCCHARLES.

Lake age in Ohio, CLAYPOLE.

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— Notes on the geological relations and mode of occurrence of some of the more important economic minerals of eastern Quebec.

Ottawa Naturalist, vol. 3, pp. 45-57. 1889.

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Detailed description of the geology of the Mosquito Range and of Leadville and vicinity. Discusses geologic history; stratigraphy and structural relations; origin of dolomites; occurrence of serpentine in Silurian rocks and elsewhere; the relations of the faults and flexures and their development; the structure of the Rocky Mountains and Basin Ranges; the succession, age, extent, texture, and composition of the eruptive rocks, the mechanism and extent of intrusion, the distribution of intrusives in the Rocky Mountains, the occurrence of laccolites in the Henry Mountains and elsewhere; contact, metamorphism, classification of ore deposits in general, and the relations, composition, and genesis of the Leadville deposits. Accompanied by maps, plans, and sections, and includes: Appendix A, Petrography, by Whitman Cross; B, Chemistry, by W. F. Hillebrand, and C, Metallurgy, by Antony Guyard.

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Am. Inst. Mining Engineers, Trans., vol. 16, pp. 49-62. 1887.

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- The submerged trees of the Columbia River.

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- Structural relations of ore deposits.

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Colorado Sci. Soc., Proc., vol. 2, pp. 189-208. 1888.

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Colorado Sci. Soc., Proc., vol. 2, pp. 251-277. 1888.

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— Zinc mining in Arkansas.

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LAWSON. Origin of ores of Keewatin, Minnesota.

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 ORTON. Reports on Ohio [oil and gas].
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A abstract of paper read to Washington Philo-
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vol. 21, pp. 841-847. 1887.

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chronism, and extent of "stratigraphic sys-
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and geologic phenomena over wide areas, in
opposition to the "World wide" classification
of geologic subdivisions. Reviews the color
scheme adopted by the Congress, and after
discussing the essentials and means of map
coloring, suggests the adoption of the pri-
matic system.

**— [Stages of geologic history of Sierra
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Washington Phil. Soc., Bull., vol. 9, p. 7,
½ p. 1887.

Remarks following paper by J. S. Diller
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— Old shore lines in the Ontario basin.

Canadian Inst., Proc., 3d series, vol. 6, pp.
2-4. 1888.

Sketch of literature. Describes search for
terraces from Aurora to Toronto.

— Changes of level of the Great Lakes.

The Forum, vol. 5, pp. 417-428. 1888.

Includes a sketch of the history of the
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**— [Views in regard to the work of the
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International Congress of Geologists, Am.
Committee Report, 1888, pp. 73-74, ½ p.

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ture, and color scheme.

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ine-basalt, nephelinite, and basalt glass.

**GILPIN, Edwin J. Notes on the lime-
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Canada Royal Soc., Trans., vol. 4, Section
IV, pp. 159-166, plate 11. 4°. 1887.

Describes the distribution and relations of
Carboniferous limestones. Analyses.

**— The Carboniferous of Cape Breton,
Part II.**

Nova Scotian Inst., Proc., vol. 7, pp. 24-35.
1888.

Stratigraphic and structural relations, and
extent of coal basins. Reference to associated
Devonian and pre-Cambrian rocks.

**— The Carboniferous of Cape Breton
with introductory remarks, Part III.**

GILPIN, Edwin J.—Continued.

Nova Scotian Inst., Proc., vol. 7, pp. 100-117. 1888.

Sketch of conditions supposed to have existed in the region during Carboniferous times. Description of general structural relations. Analyses of the coals and references to their thicknesses and relations at some points.

— The faults and foldings of the Pictou coal field.

Canada, Roy. Soc., Trans., vol. 5, Section IV, pp. 25-30, 4°. 1888.

Discussion of relations of the faults to the folds and the history of the development of the structure of the region; the former extent of the coal series; the age and relations of the folds and faults in the underlying Silurian and Cambro-Silurian, and the date of the granitic intrusions.

— Notes on the Nova Scotia gold veins.

Canada, Royal Soc., Trans., vol. 6, Section IV, pp. 63-70, pl. 3. 4°. 1889.

Prefaced by a brief account of the auriferous series and discussion of the mechanism of an ideal anticlinal.

— The geology of Cape Breton. The minerals of the Carboniferous.

Nova Scotian Inst., Proc., vol. 7, pp. 214-226. 1889.

Includes brief accounts of occurrence of gypsum, iron-ores, limestone, and building stones.

Glasgow Geological Society, Transactions, vol. 8.

Geology of Idaho, THOMSON.

GOODALE, Charles W. The occurrence and treatment of the argentiferous manganese ores of Tombstone district, Arizona.

Am. Inst. Mining Engineers, Trans., vol. 17, pp. 767-774. 1889.

Includes a brief reference to the geologic relations of the district.

[**GOODFELLOW, George E.**] The Sonora earthquake.

Science, vol. 11, pp. 162-166. 1888.

Description of great fault and other disturbances due to the earthquake.

GOODYEAR, W. A. Petroleum, asphaltum, and natural gas.

California, Seventh Report of State Mineralogist, pp. 63-114. 1888.

Description of bituminous rocks and some of their relations in Contra Costa, Fresno, Kern, Los Angeles, Monterey, Santa Barbara, San Bernardino, Santa Clara, Santa Cruz, San Luis Obispo, San Mateo, and Ventura counties.

GOODYEAR, W. A.—Continued.

— Coal.

California, Seventh Report of State Mineralogist, pp. 117-178. 1888.

Reprint of "The coal mines of the western coast of the United States," with additions and corrections up to 1887.

— Inyo County.

California, Eighth Report of State Mineralogist, pp. 221-300. 1888.

Description of relations and structure of metamorphic, granitic, and volcanic formations in parts of the county, and discussion of the nature and relations of the granites. Includes a paper by J. D. Whitney (pp. 288-300), on "The Owens Valley Earthquake," reprinted from the "Overland Monthly," 1872.

— Kern County.

California, Eighth Report of State Mineralogist, pp. 309-324. 1888.

References to granitic, metamorphic, Tertiary, and volcanic rocks and structure at various localities.

— Los Angeles County.

California, Eighth Report of State Mineralogist, pp. 335-342. 1888.

References to geologic relations at various localities and along several routes. Tertiary, Cretaceous, superficial deposits, and granitic and metamorphosed rocks.

— San Bernardino County

California, Eighth Report of State Mineralogist, pp. 504-512. 1888.

References to granites, limestones, metamorphics, sandstones, volcanics, and structural relations at various localities.

— San Diego County.

California, Eighth Report of State Mineralogist, pp. 516-523. 1888.

References to granitic and metamorphic rocks, Tertiary sandstones, dips, terraces, and superficial deposits.

— Tulare County.

California, Eighth Report of State Mineralogist, pp. 643-652. 1888.

Includes some brief references to granites and metamorphosed rocks, dips at various points, the metamorphic nature of the granites, and reprint of a paper, "Notes on the high Sierra south of Mount Whitney," from Cal. Acad. Sci., Proc., Nov., 1873.

GORLEY, S. S. Geology of Tippecanoe County.

Indiana, Department of Geol. and Nat. Hist., Fifteenth Report, 1886, pp. 61-96. 1886.

Describes formations from Niagara to lower coal measures, conglomerate, and drift. Discusses origin of some topographic and drainage features.

— Geology of Washington County.

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Indiana, Department of Geol. and Nat. Hist., Fifteenth Report, 1886, pp. 117-153, plate. 1886.

Describes the distribution, topography, structure, fossils, and stratigraphy of the Chester, St. Louis, Keokuk, Burlington, and Knobstone groups, and the superficial clays and sand. Discusses the equivalency of some of the formations.

— **Geology of Benton County.**

Indiana, Department of Geol. and Nat. Hist., Fifteenth Report, 1886, pp. 198-220. 1886.

Describes the Keokuk and St. Louis limestones, the conglomerate sandstones, and the drift deposits. Discusses the character of certain drift ridges and gives a number of bored-well records in various parts of the county.

— **The Wabash arch.**

Indiana, Department of Geol. and Nat. Hist., Fifteenth Report, 1886, pp. 228-241. 1886.

Describes a low anticlinal, extending along the course of the Wabash River from the Ohio line through Indiana, and into Illinois. Gives an account of the associated structural features, faults, flexures, jointing, and cone-in-cone structure. Discusses the age of the uplift, which is thought to have taken place in the latter part of the upper Silurian.

— **and LEE, S. E. Geology of Boone County.**

Indiana, Department of Geol. and Nat. Hist., Fifteenth Report, 1886, pp. 160-176. 1886.

Describe its drift deposits, which, in one region, are thought to be morainal in character. Give a number of well records and state their opinions in regard to the underlying rocks of the county.

GORDON, C. H. [Well at Keokuk, Iowa.]

Am. Geologist, vol. 2, p. 362, $\frac{1}{2}$ p. 1888.

Reference to horizon of supposed Niagara sandstone and to the occurrence of a similar sandstone in wells at Albert Lea, Minnesota, and Washington, Iowa.

— **[Notice of deep boring at Keokuk.]**

Am. Geologist, vol. 4, p. 127, $\frac{1}{2}$ p. 1889.

Reference to beds passed through at depths from 1,050 to 1,770 feet.

— **Notes on the geology of southeastern Iowa.**

Am. Geologist, vol. 4, pp. 237-239. 1889.

Gives records of some deep borings and comments on the more noteworthy stratigraphic evidence they present.

GRANT, Uly. S. Report of geological observations made in northeastern Minnesota during the summer of 1888.**GRANT, Uly. S.—Continued.**

Minnesota, Geol. and Nat. Hist. Survey, Seventeenth Report, pp. 149-215. 1889.

Itinerary notes, mainly on the region from Vermilion Lake east to Gunfint Lake, and relating mostly to relations of the gabbro and red syenite, and magnetite quartzite at Frazer and Thomas lakes.

GRATACAP, Louis P. [Microscopic nature and origin of Staten Island serpentines.]

Staten Island, Nat. Sci. Assoc., Proc., May 14, 1887, 2d leaf.

Discusses the several theories of serpentine formation and presents facts indicative of the derivation from hornblende rocks of the serpentine of Staten Island.

— **Preliminary list of Paleozoic fossils found in the drift of Staten Island.**

Staten Island, Nat. Sci. Assoc., Proc., [Jan. 8, 1887,] extra, No. 6, 2 leaves.

From Potsdam to upper Helderberg.

— **The eozoneal rock of Manhattan Island.**

Am. Jour. Sci., 3d series, vol. 33, pp. 374-378. 1887.

Describes the occurrence and literature of the belt of serpentines on New York Island, giving an account of their micropetrography and discussing the origin of their constituent minerals. Evidence is presented which is thought to indicate the probable inorganic character of the eozoneal structure.

— **[Notice of occurrence of boulder of Oriskany sandstone on Staten Island.]**

Staten Island, Nat. Sci. Assoc., Proc., March, 1889.

Am. Naturalist, vol. 23, pp. 549-550, $\frac{1}{2}$ p. 1889.

Includes a list of the twenty species of fossils which it contained.

GREGG, A. Economic minerals of San Saba County.

Texas, Geol. and Mineralogical Survey, First Report, 1888, pp. 74-76. 1889.

Includes geologic notes, mainly in regard to the marbles near San Saba.

GREEN, W. Spotswood. Explorations in the glacier region of the Selkirk range, British Columbia.

Royal Geog. Soc., Proc., vol. 11, pp. 153-169. 1889.

Includes some brief references to nature of rocks, terraces, and evidence of glaciation.

GRESLEY, W. S. Formation of coal-seams.

Eng. and Mining Jour., vol. 45, p. 338, $\frac{1}{2}$ col. 4^o. 1888.

Discusses method of accumulation of materials.

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[**HAGGIN, J. B.**] Record of strata in artesian well. [Kern County.]

California, Sixth Annual Report of the Mineralogist, part I, pp. 56-57. 1886.

Through gravels, sands, and clays to 650 feet in one well and 472 feet in the other.

HAGUE, Arnold. Report . . . Yellowstone Park division.

U. S. Geol. Survey, Sixth Annual Report, 1884-85, pp. 54-59. 1885.

Incidentally refers to some geologic features of the park.

— Geological history of the Yellowstone National Park.

Am. Inst. Mining Engineers, Trans., vol. 16 pp., 783-803. 1888.

Abstract, Popular Science Monthly, vol. 36, pp. 282-283, $\frac{1}{2}$ p. 1889.

References to geology of surrounding ranges, pre-Tertiary uplifts, glaciation, rock decomposition, and antiquity and rate of growth of hot spring deposits, and sketch of Tertiary volcanic history of the park.

— [On the Archean and its subdivisions.]

International Congress of Geologists, Am. Committee Reports, 1888, A, pp. 66-67.

Discusses the distinctness of the Archean as a system, separateness of the Huronian, and the subdivision and classification of eruptives in the Archean.

[—] [On the use of the term "Taconic."]

International Congress of Geologists, Am. Committee Reports, 1888, B, p. 17, 2 lines.

Am. Geologist, vol. 2, p. 207. 1888.

Suggestion in regard to its application.

— Notes on the occurrence of a leucite rock in the Absaroka range, Wyoming Territory.

Am. Jour. Sci., 3d series, vol. 38, pp. 43-47. 1889.

Abstract, Am. Naturalist, vol. 23, p. 811, $\frac{1}{2}$ p. 1889.

Account of a boulder of leucite rock; and discussion of its petrography, composition, and origin. Includes a petrographic description by J. P. Iddings, an analysis by J. E. Whitfield, and a list of localities of leucite-bearing rocks in various parts of the world.

HALL, C. W. A brief history of copper mining in Minnesota.

Minnesota, Acad. Sci., Bull., vol. 3, part 1, pp. 105-111. 1889.

Prefaced by an account of the Keweenaw formation, and brief discussion of its extent in Minnesota.

HALL, C. W.—Continued.

— The lithological characters of the Trenton limestone of Minneapolis and St. Paul, with a note on the borings of the West Hotel artesian well.

Minnesota, Acad. Sci., Bull., vol. 3, part 1, pp. 111-124, pl. 1. 1889.

Detailed description of Trenton and the underlying St. Peter sandstone in the vicinity of the city. Analyses. Well record. Reference to glacial striae and thickness of drift.

— The geological conditions which control artesian well borings in south-eastern Minnesota.

Minnesota, Acad. Sci., Bull., vol. 3, part 1, pp. 128-143, pl. 2. 1889.

Includes an account of the stratigraphy of the region, and records of a dozen wells.

— The distribution of the granites of the Northwestern States and their general lithologic characters. [Abstract.]

Am. Assoc. Adv. Science, Proc., vol. 37, pp. 189-190. 1889.

List of localities, summary of petrographic characteristics, and reference to age.

— Field notes on the geology of the Mohawk valley. See [Beecher, C. E., and Hall, C. E. ?]

HALL, James. Report on building stones.

New York, Thirty-ninth Report State Museum of Nat. Hist., 1885, pp. 136-227. 1886.

Description of some of the gneisses, granites, and marbles of New York and New England and the limestones and sandstones of New York. Discusses the qualities, selection, and causes of decay in building stones.

— Report of the State Geologist.

New York, Thirty-ninth Report State Museum of Nat. Hist., 1885, pp. 228-227. 1886.

New York, Sixth Report of the Geologist, 1886, pp. 5-9. 1887.

Includes an account of contacts of Laurentian gneisses and overlying rocks near Little Falls, and a statement in regard to the horizon of the Oneonta sandstone.

— [On the nomenclature of the American lower Paleozoic.]

International Congress of Geologists, Am. Committee Reports, 1888, B, p. 10, $\frac{3}{4}$ p.

Am. Geologist, vol. 2, p. 200. 1888.

On the adoption of exclusively European terms, and the application of the term "Taconic."

[**HANKS, Henry.**] Building stones and building materials in California.

California, Sixth Annual Report of the Mineralogist, part 1, pp. 16-34. 1886.

Description of well known building stones and of California localities. Gives partial analyses of a dunyte from San Diego County and a sandstone from Santa Barbara.

[—] Mount St. Helena.

California, Sixth Annual Report of the Mineralogist, part 1, pp. 78-79, 2 plates. 1886.

Description of outcrop of columnar basalt. Considers the mountain an old volcano, but finds no evidence of a crater.

[—] San Diego County.

California, Sixth Annual Report of the Mineralogist, part 1, pp. 80-90, map. 1886.

Incidental geologic and mineralogic notes. Describes fold in slates in mine at Banner. Accompanied by a colored geologic map of the county, provisionally illustrating the distribution of Quaternary, Tertiary, Perno-Carboniferous, and Archean.

[—] California minerals.

California, Sixth Annual Report of the Mineralogist, part 1, pp. 91-141. 1886.

Includes descriptions of some localities of lignite, various kinds of quartz, limestones, and serpentines.

— On the occurrence of hanksite in California.

Am. Jour. Sci., 3d series, vol. 37, pp. 63-66. 1889.

References to various localities and record of 300-foot bore-hole into volcanic sand, and lacustrine deposits underlying Borax Lake.

HARDEN, Oliver B. See **PROSSER, A. G.**, and.

HARKER, Alfred. The Cortlandt rocks.

Geol. Magazine, 3d decade, vol. 4, pp. 431-432. $\frac{1}{2}$ p. 1887.

Calls attention to Callaway's oversight of the present views of Dana and Williams in regard to the probable eruptive nature of some of the Cortlandt rocks which Dana at first considered metamorphic.

HARROD, B. M. Archean rocks in Texas.

New Orleans Acad. Sci., Papers, vol. 1, No. 2, pp. 131-133. 1888.

Brief references to outcrops and characteristics.

Harvard, Museum Comparative Zoölogy, Bulletin, vol. 16.

Dike of diabase in Boston basin, **HOBBS.**

Cambrian district of Bristol County, Massachusetts, **SHALER.**

Harvard Museum Comparative Zoölogy, Bulletin, vol. 16—Continued.

Fossil plants from Golden, Colorado, **LESQUEREUX.**

Faults in Trias near Meriden, Connecticut, **DAVIS.**

Triassic trap sheets of Connecticut valley, **DAVIS** and **WHITTLE.**

— vol. 17.

Coral reefs of Hawaiian Islands, **AGASSIZ.**

Harvard Museum Comparative Zoölogy, Memoirs, vol. 16, No. 2.

Connection of eastern and western coal fields, Ohio valley, **SHALER.**

Hawaiian Islands.

coral reefs, **AGASSIZ.**

genesis, **HITCHCOCK.**

Halema'ua'u and its débris cone, **DANA, J. D.**

Mount Loa craters, **BAKER. DANA, J. D. MERRITT.**

Petrography, **DANA, E. S.**

HAWORTH, Erasmus. A contribution to the Archean geology of Missouri.

Am. Geologist, vol. 11, pp. 280-297, 363-382, part 1. 1888.

Abstracts, Johns Hopkins Univ., Circulars, vol. 7, pp. 70-71, No. 65. 4°. 1888. Am. Naturalist, vol. 22, pp. 739, 838. $\frac{1}{2}$ p.

General description of relations of the massive rocks to each other and to the stratified rocks, and petrographic description of granites, porphyries, and diabases.

HAY, O. P. On the manner of deposit of the glacial drift.

Am. Jour. Sci., 3d series, vol. 34, pp. 52-58. 1887.

Statement of the views of Dana, the Geikies, Newberry, and N. H. Winchell. Discusses the action of the glacier on its bed, in general and under varying circumstances, and the mode of accumulation of drift-material at its base and in the terminal moraine.

— The northern limit of the Mesozoic rocks in Arkansas.

Arkansas, Geol. Survey, Report for 1888, vol. 2, pp. 261-290. 1888.

Descriptions of outcrops, and relations of the Cretaceous in the vicinity of the Mesozoic-Paleozoic boundary line.

— A geological section in Wilson County, Kansas.

Kansas Acad. Sci., Trans., vol. 10, pp. 6-8, plate. 1888.

Discussion of rate of dip, evidence of a fault, and equivalency of the Dun limestone with the Humboldt limestone.

HAY, O. P.—Continued.

— Report on geology.

Kansas Acad. Sci., Trans., vol. 10, pp. 21-22. 1888.

Discussion of the eastern extension of the Tertiary in southern Kansas, and the equivalency and boundary of the red rocks and gypsum in the region extending from Comanche County to Medicine Lodge.

— Natural gas in eastern Kansas.

Kansas Acad. Sci., Trans., vol. 10, pp. 57-62, plate. 1888.

Abstract from Fifth Report of State Board of Agriculture.

Reference to geologic position of gas-yielding beds. Gives sections at Fort Scott, and refers to the stratigraphic and structural relations in that vicinity. Partial section from Fort Scott, Kansas, to Nevada, Missouri, on plate.

— Note on a remarkable fossil.

Kansas Acad. Sci., Trans., vol. 10, pp. 128-129, 1 p., plate. 1888.

Includes brief discussion of the derivation of the enclosing concretion in its bearing on the location of the former eastern boundary of the Cretaceous.

— Horizon of the Dacotah lignite.

Kansas Acad. Sci., Trans., vol. 11, pp. 5-8. 1889.

Abstract, *Am. Geologist*, vol. 5, pp. 249-250, 5 lines. 1890.

References to the relations, stratigraphy and distribution of the Dacotah group, and discussion of evidence bearing on the horizon of the lignitic beds.

— Lecture. The geology of Kansas.

Kansas Acad. Sci., Trans., vol. 11, pp. 35-37. 1889.

References to distribution and relations of the Jura-Trias, Cretaceous, and Tertiary.

— The Triassic rocks of Kansas. [Abstract.]

Kansas Acad. Sci., Trans., vol. 11, pp. 38-39, 1 p. 1889.

Abstract, *Am. Geologist*, vol. 5, p. 250, 3 lines. 1890.

References to their relations to the Permian-Carboniferous and absence of unconformity at their base.

— Recent discoveries of rock salt in Kansas. [Abstract.]

Am. Assoc. Adv. Science, Proc., vol. 37, pp. 184-185. 1889.

Statements in regard to its stratigraphic position and relations, and brief sketch of the Permian-Dacotah history of the region.

— and **THOMPSON, A. H.** Historical sketch of geological work in the State of Kansas.**HAY, O. P.—Continued.**

Kansas Acad. Sci., Trans., vol. 10, pp. 45-52. 1888.

Statements of the conclusions of each observer, and description of some unpublished papers in which information is given in regard to the eastern dip of the strata in the eastern part of the State, and the now known order of Kansas formations.

HAYDEN, F. V. Report Montana division.

U. S. Geol. Survey, Sixth Report, J. W. Powell, 1884-'85, pp. 43-53. 1885.

Statement of results of studies in the region between the Bridger or East Gallatin range and the three forks of the Missouri. Briefly describes the structure and stratigraphy of the several formations—including the newly discovered Devonian—the lake deposits of the Gallatin valley, and the drift.

— Report Montana division of geology.

U. S. Geol. Survey, Seventh Report, J. W. Powell, 1885-'86, pp. 85-87. 1888.

Reference to relations of formations from Cambrian to Carboniferous and coals, and evidence of glacial action in the Gallatin range region, and to the volcanic constituents, age, origin, and relations of the lake beds of Gallatin valley.

HEADEN, William P. [Notice of a thin bed of infusorial earth in west Denver.]

Colorado Sci. Soc., Proc., vol. 2, p. 183, 1 p. 1888.

HEILPRIN, Angelo. Explorations on the west coast of Florida and in the Okeechobee wilderness, with special reference to the geology and zoölogy of the Floridian peninsula.

Wagner Inst., Trans., vol. 1, pp. i-viii, 1-134, pls. II, 1-19. 1887.

Abstracts, *Am. Jour. Sci.*, 3d series, vol. 34, pp. 230-232. 1887. *Popular Science Monthly*, vol. 33, p. 418, 1 p. 1887.

Describes outcrops and occurrence of fossils. Summarizes observations on rocks of Homosassa, Cheesawiska, Pithlachascotee, Manatee, and Caloosahatchee rivers, Tampa Bay, Hillsboro, and Sarasota Bay. Discusses literature, extent, equivalency, and paleontology of the subdivisions of the Tertiary; the coral-reef theory, and the general geologic history of the peninsula. Gives a table showing the relations of the "Atlantic and Gulf coast Tertiaries of the United States."

— [On the classification of the Tertiary deposits.]

International Congress of Geologists, Am. Committee Reports, 1888, F, pp. 12-14.

HEILPRIN, Angelo—Continued.

Am. Geologist, vol. 2, pp. 278-280. 1888.

Discussion of upper limit of Tertiary and nomenclature.

- [—] [Remarks on P. R. Uhler's paper on the Alburipian and associated formations in Maryland.]

Am. Phil. Soc., Proc., vol. 25, p. 54, $\frac{1}{2}$ p. No. 127. 1888.

Expression of opinion that part of the "Alburipian" is Paleozoic, and in regard to the age of the Potomac formation.

- The Miocene mollusca of the State of New Jersey.

Philadelphia Acad. Sci., Proc., 1887, p. 337.

Lists of fossils, notes on new and old species, and expression of opinion regarding age and equivalency of the Miocene members at Shiloh and in the Atlantic City well.

- [—] Determination of the age of rock deposits.

Philadelphia Acad. Sci., Proc., 1887, p. 335.

Discussion of rates of deposition.

- The classification of the post-Cretaceous deposits.

Philadelphia Acad. Sci., Proc., 1888, pp. 314-322.

Review of faunal relations and equivalency of the Tertiary formations mainly in the United States; and discussion of the value of the faunal element in geologic chronology.

- The Bermuda Islands; a contribution to the physical history and zoölogy of the Somers Archipelago, with an examination of the structure of coral reefs, pp. 231, pls. 17. *Philadelphia*. 1889.

Includes an account of their geology and physiography, a discussion of the coral-reef problem, and a review of recent literature on coral reefs.

- On Archean. See **FRAZER**. Report on the Archean.

HENRICH, Carl. The San Pedro copper mine in New Mexico.

Eng. and Mining Jour., vol. 43, p. 183. 4°. 1887.

Statement of character and dip of containing limestones.

- The copper ore deposits near Morenci, Arizona.

Eng. and Mining Jour., vol. 43, pp. 202-203, 219-220. 4°. 1887.

Description of geologic relations of containing formations.

HENRICH, Carl—Continued.

- Some forms of ore deposits in limestone.

Eng. and Mining Jour., vol. 46, pp. 363-369. 4°. 1888.

Reference to attitude and evidences of internal erosion of limestones inclosing lead ores in Morgan County, Missouri, and Beaverhead County, Montana.

- The United and Champion copper mines of New Zealand.

Eng. and Mining Jour., vol. 46, pp. 414-416. 4°. 1888.

Description of geologic relations of great "Serpentine" dikes in which the ores occur.

- Metamorphism in rocks.

Eng. and Mining Jour., vol. 46, p. 461, $\frac{1}{2}$ p. 4°. 1888.

Discusses the agency of highly heated underground waters under great pressure.

- Notes on the geology and on some of the mines of Aspen Mountain, Pitkin County, Colorado.

Am. Inst. Mining Engineers, Trans., vol. 17, pp. 156-206. 1889.

Stratigraphy of beds from Cambrian to Carboniferous, structural relations, faults, intrusives, and ore deposits. Mainly a discussion of structural relations.

- The Slaybach lode—a peculiar kind of fissure vein.

Eng. and Mining Jour., vol. 48, p. 27, $\frac{1}{2}$ p. 4°. 1889.

Includes some statements in regard to relations of associated volcanic rocks, and dikes.

- Is a faulted fissure always the oldest? A study of faults.

Eng. and Mining Jour., vol. 48, p. 150, $\frac{1}{2}$ p. 4°. 1889.

Discussion of mechanism of crossed faults.

HERRICK, C. L. A sketch of the geological history of Licking County, accompanying an illustrated catalogue of Carboniferous fossils from Flint Ridge, Ohio.

Denison Univ., Bull., vol. 2, pp. 5-68, pls. I-VI, pp. 144-148. 1887.

Detailed description of the geologic relations, the outcrops, structure, and characteristics of the Waverly and immediately overlying rocks. Discusses the mode and rate of deposition of the formations, the origin of their materials, and their paleontologic relations. Gives structural and columnar sections.

- The geology of Licking County, Ohio, part III.

HERRICK, C. L.—Continued.

Denison Univ., Bull., vol. 3, pp. 13-110, pls. 1-XII. 1888.

Abstracts, *Am. Jour. Sci.*, vol. 37, pp. 317-318, $\frac{1}{2}$ p., 1889; *Am. Geologist*, vol. 3, p. 50, $\frac{1}{2}$ p. 1889.

Discussion of the stratigraphic position and range of the Waverly and description of its stratigraphy, paleontology, and inclination, and of evidence of local unconformity in the sub-Carboniferous at some points. List of fossils, pp. 27-37.

— **Geology of Licking County, part IV.**

Denison University, Bull., vol. 4, pp. 11-60, 97-123, pls. I-XI. 1888.

Abstracts, *Am. Jour. Sci.*, 3d series, vol. 37, pp. 317-318, $\frac{1}{2}$ p., 1889; *Am. Geologist*, vol. 3, p. 50, $\frac{1}{2}$ p. 1889.

Pages 11-60 and 114-123, descriptions and lists of fossils.

Pages 97-114, discussion of stratigraphy of Waverly and associated series.

— **Notes on the Waverly group in Ohio.**

Am. Geologist, vol. 3, pp. 94-99, pls. I-IV. 1889.

Discussion of the equivalency, taxonomy, and paleontologic relations of the Waverly members.

— **CLARKE, E. S. and DEMING, J. L.**
Some American norytes and gabbros.

Am. Geologist, vol. 1, pp. 339-346, pl. 1888.

Discussion of the modifications induced in basic eruptives by the interpenetrated rocks and description of occurrence and petrography of olivine norytes and adjacent rocks near Marshall, North Carolina, the Duluth gabbros and the garnetiferous gabbros from Granite Falls, Minnesota. Review of Wadsworth on the origin of diorites.

— **TIGHT, W. G. and JONES, H. L.**
Geology and lithology of Michipicoton Bay.

Denison Univ., Bull., vol. 2, pp. 119-143, pls. 10-13. 1887.

Abstracts, *Am. Jour. Sci.*, 3d series, vol. 34, p. 12, $\frac{1}{2}$ p. 1887; *Am. Naturalist*, vol. 21, pp. 654-655, pls. 22-23, 1887, (by Herrick?).

After reviewing the work of previous observers, especially McFarlan, describe the geologic features of the region and the micro-petrography and mode of occurrence of a series of rock specimens. Discuss the nature, relative positions, stratigraphic and structural relations, variations and equivalency of the Laurentian, Huronian, and Keweenawan series. Illustrated by maps and structural and micro-rock sections.

HEWETT, G. C. The northwestern Colorado coal region.

Am. Inst. Mining Engineers, Trans., vol. 17, pp. 375-380. 1889.

HEWETT, G. C.—Continued.

Statement in regard to geologic horizon distribution of the coals and the stratigraphy of the region. Notice of recent lava flows.

HICKS, Henry. The Cambrian of North America.

Geol. Mag., 3d decade, vol. 4, pp. 1. 1887.

Summarization of Walcott's views on use of the term Cambrian and the faunal stratigraphic relations and equivalency subdivisions of the formation.

— [Remark on equivalency of Huronian with the Peibidian.]

Geol. Soc., Quart. Jour., vol. 44, p. 8. 1888.

HICKS, Lewis E. [Diatomaceous on North Loup River, Nebraska.]

Am. Geologist, vol. 1, p. 136, $\frac{1}{2}$ p. 1888. Notice of its occurrence and thickness.

— **Geyserite in Nebraska.**

Am. Geologist, vol. 1, pp. 277-280, vol. 437. 1888.

Reference to occurrences of volcanic in Nebraska, and extracts from "P. geography and geology of Nebraska, by Samuel Aughey on polishing powder supposed infusorial earth and geyser f

— **The reef-builders.**

Am. Geologist, vol. 1, pp. 297-305. 1888. Discussion of the theories of Darwin and Murray.

— [Volcanic dusts from Krakatoa from Nebraska and Kansas.]

Am. Geologist, vol. 2, p. 64, $\frac{1}{2}$ p. 1888. Reference to evidence of their volcanic nature.

— [Quartzite between Niobrara, O'Neil, Nebraska, and its relation to the Valentine quartzite.]

Am. Geologist, vol. 2, pp. 351-352, $\frac{1}{2}$ p. 1888. Reference to occurrence of quartzite road from Niobrara to O'Neil, Nebraska. Discussion of its age and equivalency; the Tertiary quartzite at Valentine, Nebraska.

— **Diatomaceous earth in Nebraska.**

Am. Jour. Sci., 3d series, vol. 35, p. 1. 1888.

List of species. Brief reference to their occurrence.

— **Soils of Nebraska as related to geological formations.**

Am. Geologist, vol. 3, pp. 36-45. 1888. Includes a preliminary geologic map and sketch of the geology of the State.

HILGARD, E. W. The equivalence in time of American marine and intra-continental Tertiaries.

Science, vol. 9, pp. 525-536. 1887.

Calls attention to the opportunities afforded for the determination of the relations of interior and gulf Tertiaries, in the region between and adjacent to the Red and Arkansas rivers. Discusses the correlation of some of the members of the two series.

— [On the use of the term "Oligocene" in the gulf region.]

International Congress of Geologists, Am. Committee Reports, 1888, F, p. 7, 6 lines.

Am. Geologist, vol. 2, p. 273. 1888.

Opinion in regard to its inapplicability.

— [On the relations of the Grand Gulf series.]

International Congress of Geologists, Am. Committee Reports, 1888, F, pp. 8-9.

Am. Geologist, vol. 2, pp. 274-275. 1888.

To associated and correlated formations.

— [On the inclusion of "Quaternary" in the Tertiary.]

International Congress of Geologists, Am. Committee Reports, 1888, F, pp. 14-15, $\frac{1}{2}$ p.

Am. Geologist, vol. 2, pp. 280-281. 1888.

Statement of opinion.

— Agriculture and late Quaternary geology.

Science, vol. 11, pp. 241-242, $\frac{1}{2}$ p. 1888.

Descriptions of evidence of an ancient drainage system in the upper San Joaquin valley, California.

HILL, Frank A. Geology and mining in the northern coal-field of Pennsylvania.

Am. Inst. Mining Engineers, Trans., vol. 15, pp. 699-707. 1887.

General description of the geologic features.

— Report on the Anthracite region.

Pennsylvania, Report of Geol. Survey, 1886, part 3, pp. 919-1329, 4 plates, 7 sheets in atlas. 1887.

Description of northern and western-middle coal-fields and discussion of structural and stratigraphic relations in some parts of the areas, pp. 925-1007. Sections in northern and eastern and western-middle fields.

— Lehigh River section continued from Lock 11, southward to the Blue Mountain.

Pennsylvania, Report of Geol. Survey, 1886, part 4, pp. 1372-1385. 1887.

Detailed description of the stratigraphy of beds from Pocono to top of Loraine slate, and of the structural relations of the region. Reference to glacial drift and striae.

HILL, Frank A.—Continued.

— Report on the metallic paint ores along the Lehigh River.

Pennsylvania, Report of Geol. Survey, 1886, part 4, pp. 1386-1408, sheet 6 in atlas. 1887.

Description of geologic relations, structure of paint beds, and sections in mines.

— Atlas southern anthracite field, part 2. *Pennsylvania Geol. Survey*, AA. 13 sheets. Harrisburg. 1889.

Colored geologic maps.

— Atlas eastern middle anthracite field, part 3. *Pennsylvania Geol. Survey*, AA. 13 sheets. Harrisburg, 1889.

Colored geologic maps, and columnar and cross sections.

— Atlas northern anthracite field, part 4. *Pennsylvania Geol. Survey*, AA. 8 sheets. Harrisburg, 1889.

Colored geologic maps, with marginal columnar sections.

— Atlas northern anthracite field, part 5. *Pennsylvania Geol. Survey*, AA. 7 sheets. Harrisburg, 1889.

Cross and columnar sections in coal-measures.

HILL, Robert T. A partial report on the geology of western Texas.

Am. Jour. Sci., 3d series, vol. 33, pp. 73-75. 1887.

Notice of G. G. Shumard's posthumous report. Describes the work of the Shumards, and points out the erroneous nature of their opinion in regard to the stratigraphic relations of the subdivisions of the Cretaceous to each other, and to the Tertiary.

— The topography and geology of the Cross-Timbers and surrounding regions in northern Texas.

Am. Jour. Sci., 3d series, vol. 33, pp. 291-303, plate 6. 1887.

Abstract, *Am. Naturalist*, vol. 21, p. 172, $\frac{1}{2}$ p. 1887.

Describes the general topographic and geologic features of Texas, and the relations of the Cretaceous. Points out the cause of the cross-timbers, and discusses their extent and geologic relations. Gives a table showing the history, position, equivalency, stratigraphy, paleontology, and occurrence of the subdivisions of the Cretaceous of northern Texas. Accompanied by a hypsometric map.

— The Texas section of the American Cretaceous.

Am. Jour. Sci., 3d series, vol. 34, pp. 287-309. 1887.

Describes the subdivisions of the Texas

HILL, Robert T.—Continued.

Cretaceous, and discusses their faunal and stratigraphic relations, extent, and equivalency with the Cretaceous of other parts of North America and of Europe. Reviews the literature and paleontology and the equivalency and horizons of the subdivisions of the American Cretaceous.

— The present condition of knowledge of the geology of Texas.

U. S. Geol. Survey, Bull., vol. 7, pp. 381-473, No. 45. 1887.

Historic sketch of geologic investigation, and summary and review of the results.

— Notes upon the Texas section of the American Cretaceous. [Abstract.]

Am. Assoc. Adv. Science, Proc., vol. 36, p. 216, $\frac{1}{2}$ p. 1888.

Refers to relations and equivalency of a new group lying below the Dakota sandstone, and the general relations of the Cretaceous members in Texas.

[—] Notes on the geology of Western Texas.

Geol. and Sci. Bull., vol. 1, No. 6, $\frac{1}{2}$ p., 4^o. 1888.

Abstract, Am. Geologist, vol. 3, pp. 51-52, $\frac{1}{2}$ p. 1889.

References to extent and inlocation of Carboniferous, divisibility of "red beds" into Permian and Jura Trias, relations of Cretaceous, Quaternary or late Tertiary of plains west of the Sweetwater, evidence of Quaternary lakes in the mountain region west of the Pecos, the terraces of the Rio Grande near El Paso, the lower Cretaceous or possible Jurassic of the southwestern region, and the Quaternary and post-Quaternary history especially of the Llano Estacado region.

— The Trinity formation of Arkansas, Indian Territory, and Texas.

Science, vol. 11, p. 21, $\frac{1}{2}$ p. 1888.

Describes the characteristics, extent, and general relations of a pre-Cretaceous Mesozoic series to which the term Trinity formation is applied.

— University of Texas. School of Geology—circular No. 1. 1 page. 1888.

References to Permian of western Texas; occurrence of Laramie along the Texas side of the lower Rio Grande; origin of the Texas Cretaceous; occurrence of Mesozoic igneous area in central Texas; the Jurassic age of the Tuncumcarri section in northwest Texas, and the existence of an extensive marine Jurassic formation in southwest Texas and adjacent parts of Mexico.

— Neozoic geology of southwestern Arkansas.

Arkansas Geol. Survey, Report for 1888, vol. 2, pp. 1-260. Map. 1888.

HILL, Robert T.—Continued.

Review by Jules Marcou, Am. Geologist, vol. 4, pp. 357-367. 1889. Abstracts. Popular Science Monthly, vol. 36, p. 129, $\frac{1}{2}$ p. 1889. Am. Geologist, vol. 4, pp. 243-246. 1889. Am. Jour. Sci., 3d series, vol. 38, pp. 413-414, $\frac{1}{2}$ p. 1889.

Systematic description of the several formations, discussions of equivalency, geologic history, extent and relations in adjoining and correlated regions, and paleontologic descriptions. Part 2 is an account of economic geology, in which the origin, classification, geologic relations, and improvement of soils are considered.

— Events in North American Cretaceous history illustrated in the Arkansas-Texas division of the southwestern region of the United States.

Am. Jour. Sci., 3d series, vol. 37, pp. 282-290. 1889.

Includes descriptions of stratigraphic and structural characteristics, discussions of equivalency, taxonomy, and paleontologic relations of some of the Cretaceous members, and brief reference to pre-Cretacic and post-Cretacic conditions in the Arkansas-Texas region.

— Ueber eine durch die Häufigkeit Hippuritenartiger Chamiden ausgezeichnete Fauna der oberjurassischen Kreide von Texas, von Ferdinand Roemer in Breslau. 1888.

Am. Jour. Sci., 3d series, vol. 37, pp. 318-319, $\frac{1}{2}$ p. 1889.

Review in which the stratigraphy is discussed.

— [Remarks on occurrence of Macraster Texanus].

Am. Naturalist, vol. 23, p. 168, $\frac{1}{2}$ p. (February No.) 1889.

Reference to its associates and stratigraphic position. Review of Roemer, Neues Jahrbuch, 1888, vol. 1, pp. 191-195, pl.

— [On the validity of some new species from the Cretaceous of Texas].

Am. Naturalist, vol. 23, p. 169, $\frac{1}{2}$ p. (February No.) 1889.

Review of Shüter "Ueber die regulären Echinodermata der Kreide Nord Amerikas," and Ueber Inoceramus und Cephalopoden der texanischen Kreide. Includes references to equivalency of Austin Cretaceous beds.

— A portion of the geologic story of the Colorado River of Texas.

Am. Geologist, vol. 3, pp. 287-299. 1889.

Abstracts, Popular Science Monthly, vol. 36, p. 573, $\frac{1}{2}$ col. 1890. Am. Naturalist, vol. 24, p. 956, $\frac{1}{2}$ p. 1890.

Descriptions of stratigraphy, structure, and

HILL, Robert T.—Continued.

overlaps, and sketch of geologic history from Cambrian to Quaternary in Travis, Burnet, and parts of adjoining counties.

- The foraminiferal origin of certain Cretaceous limestones, and the sequence of sediments in North American Cretaceous.

Am. Geologist, vol. 4, pp. 174-177. 1889.

Discusses the nature of the lower Cretaceous limestones, and summarizes the history of deposition of the Cretaceous of the Texas region.

- Paleontology of the Cretaceous formation of Texas. Part I. University of Texas school of geology, pp. 5, pls. 3, Austin. 1889.

Abstract, *Popular Science Monthly*, vol. 36, pp. 424-425, ½ col. 1890.

Includes a reference to the relations of the Vola limestone of the Comanche series near Austin.

- The Permian rocks of Texas.

Science, vol. 13, p. 92, ½ col. 1889.

Calls attention to the presence of a Permian-Triassic series, and suggests their extension to the Kanab Valley section in Utah.

- and **PENROSE, R. A. F., jr.** Relation of the uppermost Cretaceous beds of the eastern and southern United States, and the Tertiary-Cretaceous parting of Arkansas and Texas.

Am. Jour. Sci., 3d series, vol. 38, pp. 468-473. 1889. Abstract, *Am. Naturalist*, vol. 24, p. 769, ½ p. 1890.

Description of the characteristics and relations of the uppermost Cretaceous members in the Texas-Arkansas region, presentation of evidence of their equivalency with the lower marls of the New Jersey region, and an account of the relations and history of the unconformity at the base of the Tertiary. Prefaced by a summary account and table of the Cretaceous members in the Arkansas-Texas region, and concluded by some suggestions in regard to Cretaceous taxonomy.

HILLEBRAND, W. F. Chemistry.

Geology and Mining Industry of Leadville, Colorado, by S. F. Emmons, U. S. Geol. Survey, Mon., vol. 12, pp. 585-608. 1886.

Analyses of eruptives, limestones, ores, vein materials, etc.

HILLS, R. C. Notes on the recent discovery of natural gas in Pitkin County, Colorado.

Colorado Sci. Soc., Proc., vol. 2, part 2, pp. 106-107. 1887.

Discussion of the horizon from which the gas is derived.

HILLS, R. C.—Continued.

- *Circulation of water through the strata of the upper Cretaceous coal measures of Gunnison County, Colorado.*

Colorado Sci. Soc., Proc., vol. 2, part 2, pp. 127-133. 1887.

Account of the strata penetrated by boreholes and general sketch of the geology of the region, illustrated by a geologic map.

- Preliminary notes on the eruptions of the Spanish Peaks region.

Colorado Sci. Soc., Proc., vol. 3, pp. 24-34, pl. 1889.

Describes structural relations of the dikes and laccolites, and discusses the history of their intrusion.

- The recently discovered Tertiary beds of the Huerfano River basin, Colorado.

Colorado Sci. Soc., Proc., vol. 3, pp. 148-164, pl. 1889.

Description of their stratigraphy, structure, distribution, volcanic contents, and relations to the Laramie, and discussion of their history, extent, and taxonomy.

- Address—The field for original work in the Rocky Mountains.

Colorado Sci. Soc., Proc., vol. 3, pp. 168-184. 1889.

General review of the present condition of knowledge of Colorado geology and summary of discoveries made since the Hayden survey. Refers to occurrence of supposed Cambrian near Ouray, the extent and stratigraphy of the Laramie, and of the Trias in the San Juan region; evidences of glaciation in the White River plateau, the occurrence of supposed Tertiary conglomerate near Ouray and Telluride, the genesis of ores, and the existence of more recent volcanic formations in various parts of the State.

HINMAN, Russell. The laws of corrosion.

Science, vol. 12, pp. 119-120, ½ p. 1888.

Reference to Powell's contributions to the subject, and suggests some exceptional conditions.

HITCHCOCK, C. H. Genesis of the Hawaiian Islands.

Am. Assoc. Adv. Science, Proc., vol. 36, pp. 222-223. 1888.

Discusses evidence of uplift, in review of Dutton.

- [On the nomenclature of the American lower Paleozoic.]

International Congress of Geologists, Am. Committee Reports, 1888, B, pp. 11-12.

Am. Geologist, vol. 2, pp. 201-202. 1888.

HITCHCOCK, C. H.—Continued.

Reference to the position of the "Taconic" rocks, the use of the term "Taconic," the use of the smaller American terms like "Niagara," and to a dual nomenclature, paleontologic and stratigraphic.

— Report of the subcommittee on the Quaternary and Recent.

International Congress of Geologists, Am. Committee Reports, 1888, H, pp. 12.

Am. Geologist, vol. 2, pp. 300-306. 1888.

Review of occurrence, characteristics, and relations of the members of the Quaternary and résumé of opinion in regard to their equivalency and correlation, and the sequence of events in Quaternary time.

— Conglomerates in New England gneisses [a letter addressed to Alexander Winchell.]

Am. Geologist, vol. 3, pp. 253-256. 1889.

Discusses the age and relations of pebble and fragment-bearing crystalline rocks in Rhode Island, New Hampshire, Vermont, and Massachusetts.

— Date of the publication of the report upon the geology of Vermont.

Boston Soc. Nat. Hist., Proc., vol. 24, pp. 33-37. 1889.

Includes a historic account and definition of the application of the term "Georgia slate," and references to the results of Walcott's studies in western Vermont.

— On the Archean. See **FRAZER**, Report on Archean.

HOBBS, William H. On the petrographical characters of a dike of diabase in the Boston basin.

Harv. Mus. Comp. Zool., Bull., vol. 16, pp. 1-12, pl. No. 1. 1888.

Also describes occurrence, textural relations in its different parts, and some features of the inclosing strata. Analyses.

— On the rocks occurring in the neighborhood of Ilchester, Howard County, Maryland: Being a detailed study of the area comprised in sheet No. 16 of the Johns Hopkins University map.

Johns Hopkins Univ., Circulars, vol. 7, pp. 69-70, 4^o, No. 65. 1888.

Abstract, Am. Naturalist, vol. 22, p. 527. 1888.

Mainly petrographic. References to sequence of the various eruptives and the relations at several localities.

— On the paragenesis of allanite and epidote as rock-forming minerals.

Am. Jour. Sci., 3d series, vol. 38, pp. 223-228. 1889.

HOBBS, William H.—Continued.

Abstract, Am. Naturalist, vol. 23, p. 721, $\frac{1}{2}$ p. 1889.

Includes a petrographic description and analysis of the granite from Ilchester, near Baltimore.

HODGE, J. M. Preliminary report on the geology of parts of Letcher, Harlan, Leslie, Perry, and Breathitt counties.

Kentucky, Geol. Survey, John R. Proctor, Director, Reports on the southeastern Kentucky coal-field, pp. 35-52, maps, plates. 1887.
Description of coal beds, and the structure and stratigraphy of the coal measures.

— Preliminary report on the geology of the lower north fork, middle and south forks, Kentucky River.

Kentucky Geol. Survey, John R. Proctor, Director, Reports on the Southeastern Kentucky coal-field, pp. 53-114, pls. 1887.

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Am. Naturalist, vol. 23, p. 1036. 1889.

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Am. Jour. Sci., 3d series, vol. 38, pp. 361-383, pl. ix. 1889.

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Am. Geologist, vol. 4, pp. 121-125. 1889.

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Abstract, British Assoc. Adv. Science, Report, 1887, pp. 703-704. 1888.

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- The genetic history of crystalline rocks.

Canada, Royal Soc., Trans., vol. 4, section III, pp. 7-37. 1887.

An examination of the orenitic "hypothesis in some of its aspects to show how far the conception of a single consolidated igneous mass under the combined action of heat and water may be made to explain satisfactorily the various facts in the history of the Earth's crystalline crust." Discusses the relations of stratified and massive crystalline rocks; foliation; variations and sources of igneous rocks; texture, composition, and minerals of vein stones, and the nature of the crystalline limestones of eastern Massachusetts and New York, and the apatite-bearing veins of Canada.

- The Taconic question restated.

Am. Naturalist, vol. 21, pp. 114-125, 238-250, 312-320. 1887.

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Reviews the stages of opinion which have been held in regard to the "Taconic" and related formations. Calls attention to Emmons's modified views in regard to the age of the "upper Taconic." Discusses the history, use, and application of the term "Taconic," the relations of the pre-Potdam strata in America, and the significance of the discoveries of Dana, Dwight, Ford, Walcott, and others, in the Taconic-Hudson River region, and Rominger and others in the Lake Superior region. Defines the term "Taconian" as applied by him, and considers the use of the word "Cambrian."

- [On subdivisions, unconformities, characteristics, origin of some members, nomenclature and life of the Archean, origin of serpentine, classification of eruptives, nomenclature of the lower Paleozoic formations.]

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- On crystalline shists.

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Am. Geologist, vol. 2, p. 187, § p. 1888.

On the nomenclature proposed by Winchell for the Cambrian rocks.

- Evolution of the faunas of the lower Lias

Boston Soc. Nat. Hist., Proc., vol. 24, pp. 17-31. 1888.

Includes references to the extent and relations of the basins in which the lower Lias of Europe was deposited, and the equivalency of some of its members.

Idaho, [Caribou Mountain,] VAN DIEST.

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IDDINGS, Joseph P. The nature and origin of lithophysæ, and the lamination of acid lavas.

Am. Jour. Sci., 3d series, vol. 33, pp. 36-45. 1887.

Abstract of a memoir to appear in the Seventh Report of the U. S. Geol. Survey. Describes the micro-structure and lithology of the spherulites and lithophysæ, and the finely laminated structure of the rhyolite of Obsidian Cliff, Yellowstone Park; and discusses the origin of these structural phenomena.

- On the origin of primary quartz in basalt.

Am. Jour. Sci., vol. 36, pp. 208-221. 1888.

Abstracts, Am. Naturalist, vol. 22, p. 1021, § p. 1888. Am. Geologist, vol. 3, p. 52, § p. 1889.

Petrographic description of quartz-bearing basalts from the Tewan Mountains, Arizona; references to other similar occurrences in California, Colorado, and Nevada, and discussion of the origin of the quartz, and the conditions involved in the solidification of eruptive masses.

- Obsidian Cliff, Yellowstone National Park.

U. S. Geol. Survey, Seventh Report, J. W. Powell, 1885-'86, pp. 249-295, pls. 9-18. 1888.

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— On the crystallization of igneous rocks.

Washington, Phil. Soc., Bull., vol. 11, pp. 65-113. 1889.

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natural gas, **PHINNEY.**

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Indiana, Department of Geology and Natural History, Fifteenth Report, 1886.

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Mesozoic realm, COPE.

Report on Cenozoic (marine), SMITH, E. A. ALDRICH. DALL. HEILPRIN.

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WHITFIELD, R. P. WINCHELL, A.

Report on Cenozoic (interior), COPE.

Report on Quaternary and recent, HITCHCOCK.

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Pennsylvania, Geol. Survey, Report for 1886, part 1, pp. 1-372, 3 pls., map in pocket, 1887.

Includes descriptions of the structural and stratigraphic relations and a detailed account of the geologic features of the southwestern counties of Pennsylvania. Accompanied by a folded, colored geologic map.

— Geological map of southwest Pennsylvania, giving the geological outcrops and tidal elevations as a basis for estimating the depths to the oil and gas sands, to illustrate Mr. Carll's report on the oil and gas regions scale, 2 miles to 1 inch. June, 1887.

Pennsylvania, Geol. Survey, Annual Report for 1886, part 2, two sheets in pocket. 1887.

The same as the sheet in part 1, with addition of columnar sections and notes by Carll.

— Report on the iron mines and limestone quarries of the Cumberland-Lebanon valley. 1886.

Pennsylvania, Geol. Survey, Report for 1886, part 4, pp. 1409-1567, maps, sheets 7-11 in atlas. 1887.

Description of structure and stratigraphy of the valley region, the mines, and the quarries of limestone and of Mesozoic sandstone. Brief discussion of the structure in the Dillsburg and Hummelstown regions, and relations of the Newark sandstone.

— and McCREATH, Andrew. The New River-Cripple Creek mineral region of Virginia, pp. 171, 4 plates, and map in pocket. Harrisburg. 1887.

Includes a description of the stratigraphy, distribution, and structure of the several formations in southern Wythe and Pulaski counties, in general and in connection with the ore deposits. Describes the Draper Mountain region in considerable detail, and discusses and figures its complicated structural relations. The report is accompanied by a colored geologic map on which topography and structure are indicated.

d'INVILLIERS and McCREATH—
Continued.

— Comparison of southern coals and iron ores. See **McCreath, A. S.** and.

— Mineral resources of the upper Cumberland valley. See **McCreath, A. S.** and.

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terraces of Missouri, **TODD.**

Iowa—Continued.

topographic types in northeastern Iowa, **MCGEE.**

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well at Keokuk, **GORDON.**

well at Washington, **CALVIN.**

Iowa State University, Bulletin, vol. 1.
Geological problem in Muscatine County, **CALVIN.****IRELAN, William, Jr.** Report of State Mineralogist.

California, Sixth Annual Report of the Mineralogist, part 2, pp. 14-62. 1887.

References to the geologic features in the vicinity of the mines in Amador, Butte, Calaveras, El Dorado, Fresno, Nevada, Sierra, and Tuolumne Counties.

— Mineral resources of the State. Considered by counties.

California, Eighth Report of State Mineralogist, pp. 22-223, 324-335, 342-352, 402-504, 512-516, 528-643, 652-678, 690-691. 1888.

Contains incidental references to occurrence, relations, and structure of metamorphic, granitic, eruptive, coal-bearing and other rocks and clays, and drifts in various localities.

[—] Natural and artificial cement.

California, Eighth Report of State Mineralogist, pp. 865-884. 1888.

Includes analyses of shell lime from southwestern California, and limestones from Santa Cruz and adjoining counties.

IRVING, Roland D. Report
Lake Superior division.

U. S. Geol. Survey, 6th Report, J. W. Powell, 1884-'85, pp. 40-48. 1885.

Includes an account of observations on the Vermilion Lake, Animikie, and associated series.

— Origin of the ferruginous schists and iron ores of the Lake Superior region.

Am. Jour. Sci., 3d series, vol. 32, pp. 255-272. 1886.

Abstract, *Popular Science Monthly*, vol. 53, p. 714, § col. 1888.

Described in bibliography for 1886.

— Is there a Huronian group? [Read to National Academy of Sciences, April, 1887.]

Am. Jour. Sci., 3d series, vol. 34, pp. 204-216, 249-263, 365-374. 1887.

Abstract, *Am. Geologist*, vol. 1, pp. 119-120. 1888.

Summarizes the evidence indicative of the distinctness of the Huronian as a group comparable with Cambrian, Silurian, etc.; the divisibility of the rocks of the Marquette, Menominee, and Penoque belts into two mem-

IRVING, Roland D.—Continued.

bers, the upper of which, and also the Animikie, being of Huronian age. Gives an account of recent field work in the Huronian region and in the district north of Lake Superior, describing the uncrystalline nature of the original Huronian rocks, and outcrops exhibiting the relations of their basal conglomerates to the underlying schists and granites. Discusses the relations of the Huronian, iron-bearing, Animikie, and Keweenaw rocks and their structure, origin, and stratigraphy; the extent of the Huronian in America; the uncertainty of age of some so-called Huronian areas in Canada, and the use of the term "group." Proposes the use of Chamberlin's term "Agnostozoic" for the great system of formations between the Paleozoic (Cambrian) and Archean.

[—] [On the use of the term "Taconic."]

International Congress of Geologists, Am. Committee, Reports, 1888, B, p. 17, 1 line.
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Expression of opinion.

— [On subdivisions, nomenclature, origin of some members, and characteristics of Archean rocks, classification of eruptives, origin of serpentines, and use of term "Taconic."]

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— Report — Lake Superior division of geology.

U. S. Geol. Survey, Seventh Report, J. W. Powell, 1885-'86, pp. 68-76. 1888.

In résumé of results refers to the origin of the ferruginous schists and their iron ores, the divisibility of the Archean, the origin of chloritic schists exposed at the falls of the Menominee River, and the origin of the upper mica schists of the iron-bearing series.

— On the classification of the early Cambrian and pre-Cambrian formations. A brief discussion of principles, illustrated by examples drawn mainly from the Lake Superior region.

U. S. Geol. Survey, Seventh Report, J. W. Powell, 1885-'86, pp. 365-454, pls. 30-51. 1888.
Abstract, Am. Geologist, vol. 4, pp. 111-112, ‡ p. 1889.

Paleontologic and lithologic characteristics, and unconformities and overlaps of various kinds. Discussion of geologic relations and equivalency of rock group in the Lake Superior region, and taxonomy of the lower part of the geologic column. Accompanied by colored geologic maps.

IVES, James T. B. Geology in the public schools.

IVES, James T. B.—Continued.

Canadian Inst., Proc., 3d series, vol. 5, pp. 125-128. 1887.

Describes a device for illustrating the simpler geologic relations.

— Iron and other ores in Ontario.

Canadian Inst., Proc., 3d series, vol. 5, pp. 185-192. 1888.

Includes a brief discussion of the horizon of some of the ores.

— [Remarks on ancient shore-line near Toronto.]

Canadian Inst., Proc., 3d series, vol. 6, pp. 4-5, 1888.

Remarks on the observations of previous writers, and statement in regard to evidence of terraces near Toronto.

JACKSON, A. Wendell. [Report on some California building stones.]

California, Seventh Report of the State Mineralogist, pp. 206-213. 1888.

Macroscopic and microscopic descriptions of Santa Susanna sandstone, Henley sandstone, Campo Seco tufa, and Colton marble.

— Building stones.

California, Eighth Report of State Mineralogist, pp. 885-894. 1888.

Describes petrography of Angel Island sandstone, Sespe brownstone, San José sandstone, Altamont sandstone, Penryn granite, Rock in granite, and Mount Raymond granite.

JAMES, Joseph F. Account of a well drilled for oil or gas at Oxford, Ohio, May and June, 1887.

Cincinnati, Soc. Nat. Hist., Jour., vol. 10, pp. 70-77. 1887.

Abstract geological section of southwestern Ohio. Am. Assoc. Adv. Science, Proc., vol. 36, p. 211, ‡ p. 1888.

Abstract by author, Science, vol. 9, p. 623. 1887.

Description of 1,365 feet of strata passed through, from the Cincinnati group to white arenaceous limestones thought to be equivalent to the Calceferous sandrock.

— The geology of Cincinnati.

Cincinnati, Soc. Nat. Hist., Jour., vol. 9, pp. 20-21, 136-141. 1886.

Abstract, "The glacial lake and island of Cincinnati," Popular Science Monthly, vol. 31, pp. 423-424.

Abstract of paper described in bibliography for 1886.

— An ancient channel of the Ohio River at Cincinnati.

Cincinnati, Soc. Nat. Hist., Jour., vol. 11, pp. 96-101. 1888.

Abstract, Am. Assoc. Adv. Science, Proc., vol. 37, p. 196. 1889.

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Description of drift-filled valleys, marking part of the course of the preglacial Ohio drainage.

— The Ivorydale well in Mill Creek valley.

Cincinnati, Soc. Nat. Hist., Jour., vol. 11, pp. 102-104. 1888.

- Description and columnar section. Brief discussion of bearing of some of the beds on glacial history.

— Section of Maquoketa shales in Iowa.

Am. Naturalist, vol. 23, p. 810, $\frac{1}{2}$ p. 1889.

Abstract of paper read to American Association, 1889. The abstract consists of some brief allusions to some of the relations of the shales.

— The geology of the Montmorenci. A correction in a date.

Am. Geologist, vol. 4, p. 387, $\frac{1}{2}$ p. 1889.

Supplies correct date of Emmons' paper of that title, and calls attention to another paper by Emmons in the American Magazine on the Hudson River rocks.

— Remarks upon sedimentation in the Cincinnati group.

Cincinnati, Soc. Nat. Hist., Jour., vol. 12, pp. 34-36. 1889.

Calls attention to evidence of the presence of beaches at several horizons in the Cincinnati group.

JAMESON, E. Geology of the Leavenworth prospect well.

Kansas Acad. Sci., Trans., vol. 11, pp. 87-88. 1889.

Includes record of 2,116-foot well.

JENNEY, Walter P. Graphitic anthracite in the Parker mine, Wood River, Idaho.

School of Mines Quarterly, vol. 10, pp. 312-315. 1889.

Description of geologic relations, and discussion of genesis.

— Notes on the dry lakes of southern Nevada and California, with relation to the loess.

School of Mines Quarterly, vol. 10, pp. 316-318. 1889.

Description of the lakes; their deposits and history.

JERMY, Gustav. Reports [south central Texas].

Texas, Geol. and Mineralogical Survey, First Report, 1888, pp. 61-64. 1889.

Notes on geologic characteristics and economic minerals in part of the region between the Nueces and Colorado rivers.

Bull. 75—7.

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— Surface geology of Burlington, Iowa.

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— Note sur le contact des formations paléozoïques et archéennes de la province de Québec.

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Canada, Royal Soc., Trans., vol. 4, section iv, pp. 167-184. 1887.

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— The diabase dikes of Rainy Lake.

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LAWSON, Andrew C.—Continued.

— Foliation and sedimentation. A reply to Prof. Alexander Winchell.

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Am. Geologist, vol. 3, pp. 276-279. 1889.

Definition of his views in regard to the history and relations of the Archean rocks of the Northwest and discussion of the nature of the so-called conglomerates in the gneisses.

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Am. Geologist, vol. 1, pp. 76-81. 1888.

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A discussion of the post-Tertiary physical changes of the coast region of California as indicated by the flora and fauna of the outlying islands.

— [Nomenclature, subdivision, characteristics, classification of eruptives, origin of some members, and evidences of life of the Archean, and on the nomenclature of the lower Paleozoic.]

International Congress of Geologists, Am. Committee, Reports, 1888, A, pp. 55-57.

— [On the use of the term "Taconic."]

International Congress of Geologists, Am. Committee, Reports, 1888, B, p. 17, 3 lines. *Am. Geologist*, vol. 2, p. 207. 1888.

— [On nomenclature of Cenozoic formations.]

International Congress of Geologists, Am. Committee, Reports, 1888, F, pp. 17-18, $\frac{1}{2}$ p.

Am. Geologists, vol. 2, pp. 283-284. 1888.

Discussion of a designation for the present time, reference to the nomenclature of the Tertiary, and the position of Cenozoic unconformity in California.

— On the origin of normal faults and of the structure of the basin region.

Am. Jour. Sci., 3d series, vol. 38, pp. 257-263. 1889.

Abstract, *Nature*, vol. 40, pp. 46-47, 16 lines. 1889.

Discussion of the origin and mechanism of faults, especially of the class to which "Great

LE CONTE, Joseph—Continued.

Basin" structure is due, and of the age and history of those in the Sierra Nevada and Great Basin.

LEE, S. E. Geology of Boone County.

See **GORLEY, S. S.**, and.

— **Maxinkuchee.** See **THOMPSON, W. H.**, and.

LEGGETT, Thomas H. Notes on the Rosario mine at San Juancito, Honduras, Central America.

Am. Inst. Mining Engineers, Trans., vol. 17, pp. 432-449. 1889.

Includes a description of the geologic features of the region and a discussion of the origin of its ores.

LEIBERG, John B. Some notes upon the more recent fossil flora of North Dakota and an inquiry into the causes that have led to the development of the treeless areas of the Northwest.

Minnesota, Acad. Sci., Bull., vol. 3, part 1, pp. 145-151. 1889.

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LESLEY, J. P. A dictionary of the fossils of Pennsylvania and neighboring States named in the reports and catalogues of the Survey. *Pennsylvania Geol. Survey Report*, P4, pages xiv, 438, xxxi. Harrisburg. 1889.

Contains incidental references to geologic formations in which some of the species occur.

— Revision and correction of the semibituminous coal section at Wellersburg in Somerset County, Pennsylvania.

Pennsylvania, Geol. Survey, Atlas to Reports, H H and H H H, pp. 349-360. 1889.

An account of the components and relations of the coal measures at that locality.

LESQUEREUX, Leo. On the character and distribution of Paleozoic plants.

Pennsylvania, Geol. Survey Report for 1886, part 1, pp. 457-522. 1887.

Includes a discussion of geologic distribution of floral remains, the genesis of coal, the evidence afforded by paleobotany of the conditions of deposition of some of the formations, and the equivalency of different members and portions of the lower Carboniferous of the United States.

— **Prof. L. F. Ward's** synopsis of the flora of the Laramie group.

Am. Jour. Sci., 3d series, vol. 34, pp. 487-498. 1887.

Review of some stratigraphic relations of the Laramie flora.

LESQUEREUX, Leo—Continued.

— fossil plants collected at Golden, Colorado.

Harv. Mus. Comp. Zool., *Bull.*, vol. 16, pp. 43-59. No. 3. 1888.

In summary, pp. 57-59, discusses stratigraphic position of the plants, and floral relations of Fort Union and Laramie groups.

— Fossil plants of the coal measures of Rhode Island.

Am. Jour. Sci., 3d series, vol. 37, pp. 229-230. 1889.

List of species and statement of opinion in regard to their age.

LEVERETT, Frank. Glacial phenomena of northern Indiana and northeastern Illinois.

Am. Naturalist, vol. 23, p. 808, $\frac{1}{2}$ p. 1889.

Nature, vol. 40, pp. 557-558, $\frac{1}{2}$ col. 1889.

Abstract of paper read to American Association. 1889.

An account of moraines.

— On the occurrence of the "forest bed" beneath intra-morainic drift. [Abstract.]

Am. Assoc. Adv. Science, Proc., vol. 37, pp. 183-184, $\frac{1}{2}$ p. 1889.

Account of its geographic and stratigraphic distribution in northeastern Illinois.

— Raised beaches of Lake Michigan.

Wisconsin Acad. Sci., Trans., vol. 7, pp. 177-192. 1889.

Description of their physiography and deposits, with incidental suggestions in regard to some details of their history.

LEWIS, Elias, jr. Woodham artesian well, on Long Island, 2 miles east of East New York, on the line of the Long Island Railroad.

Am. Jour. Sci., 3d series, vol. 37, p. 233, $\frac{1}{2}$ p. 1889.

Five hundred and seventy-seven feet through drift to gneiss.

LEWIS, H. Carvill. Comparative studies upon the glaciation of North America, Great Britain, and Ireland.

Rept. Fifty-sixth Meeting, British Assoc. Adv. Sci., 1886, pp. 632-635. 1887.

Geol. Magazine, 3d decade, vol. 4, pp. 28-32. 1887.

Described in the bibliography for 1886.

— On some important extra-morainal lakes in central England, North America, and elsewhere during the period of maximum glaciation, and on the origin of extra-morainal boulder-clays.

Nature, vol. 36, p. 573, $\frac{1}{2}$ p. 1887.

LEWIS, H. Carvill—Continued.

Geol. Magazine, 3d decade, vol. 4, pp. 515-517. 1887.

British Assoc. Adv. Science, Proc., Report, 1887, pp. 692-693. 1888.

Points out the relations of extra-morainic clay deposits in America and in general, and discusses the location and extent of extra-morainic lakes indicated by deposits of bowlder-clay in England, and the nature of the glaciation of England.

— [Remarks on P. H. Uhler's paper on the Alburpean formation in eastern Maryland.]

Am. Phil. Soc., Proc., vol. 25, pp. 53-54. No. 127. 1888.

Objections to the term "Alburpean," and suggestion that its sandstone members are in part Paleozoic.

LINDAHL, Joshua. Dr. N. O. Holst's studies in glacial geology.

Am. Naturalist, vol. 22, pp. 589-598, 705-713. 1888.

Condensed translation of "Om de glaciala rullstensåsarne," and "Berättelse om en i geologiskt syfte företagen resa till Grönland."

LINDGREN, Waldemar. The silver mines of Calico, California.

Am. Inst. Mining Engineers, Trans., vol. 15, pp. 717-734, plate. 1887.

Description and sections of the region, and discussion of the lithologic, stratigraphic, and structural features of the "Tertiary" sandstones, tuff deposits, "liparite," and andesite, and their relations to the ore deposits.

— Notes on the geology of Baja, California, Mexico.

California Acad. Sci., Proc., 2d series, vol. 1, pp. 173-196, pls. 1-5. 1889.

Description of Pleistocene, Tertiary, Cretaceous, eruptives, basal granites, and structural features. Illustrated by plates of cross-sections and colored geologic map.

LINNEY, W. M. Report on the geology of Clark County.

Kentucky, Geol. Survey, John R. Proctor, Director, Report on the Geology of Clark and Montgomery Counties, pp. 1-43. Map. [1887?]

Description of stratigraphy of beds from Chazy limestone to lower coal measures. Accompanied by a colored geologic map with cross-section.

— Geological Survey of Kentucky, John R. Proctor, Director. Reports on the geology of Bath [and Fleming counties], 86 pages. Map. [Date?]

Description of formations from Carboniferous to Ordovician; considers silicification and

LINNEY, W. M.—Continued.

alteration in texture in some of the limestones; gives an account of the flexures of the region. Illustrated by a colored geologic map.

— Geological Survey of Kentucky, John R. Proctor, Director. Report on the geology of Garrard County, pp. 31. Map. [1888?]

Description of beds from Chazy limestone to upper sub-Carboniferous. List of fossils. Accompanied by a colored geologic map.

— Geological Survey of Kentucky, John R. Proctor, Director. Reports on the geology of Henry, Shelby, and Oldham counties, 70 pages. Map. [Date?]

Descriptions of formations from Ordovician to Devonian, alluvial terraces, and disturbances. Illustrated by colored geologic map.

— Geological Survey of Kentucky, John R. Proctor, Director. Report on the geology of Lincoln County, 37 pages. Map. [1887?]

Description of beds from Trenton limestone to sub-Carboniferous, and structural relations. Accompanied by a colored geologic map.

— Geological Survey of Kentucky, John R. Proctor, Director. Report of the geology of Mason County, 31 pages. Map. [Date?]

Description of formations from Niagara to lower Hudson, and alluvial. List of fossils. Illustrated by colored geologic map.

— Geological Survey of Kentucky, John R. Proctor, Director. Report on the geology of Mercer County, 29 pages. Map. [1887?]

Description of beds from Chazy limestone to sub-Carboniferous. Brief references to flexures. Accompanied by a colored geologic map.

— Report on the geology of Montgomery County.

Kentucky, Geol. Survey, John R. Proctor, Director, Report on the Geology of Clark and Montgomery Counties, pp. 45-75. Map. [1887?]

Description of stratigraphy of beds from Trenton limestone to lower coal measures and of structural relation and fault in Clark and Montgomery counties. Discussion of conditions under which some of the formations were deposited, evidence of erosional unconformities between some of the beds, and the extent and relations of the fault.

— Report on the geology of Nelson County.

LINNEY, W. M.—Continued.

Kentucky, Geol. Survey, John R. Proctor, Director, Report on Spencer and Nelson Counties, pp. 21-58. Map. * [1888?]

Description of beds from lower Hudson to upper sub-Carboniferous. Reference to position and relations of uplift. Accompanied by a colored geologic map.

— Report on the geology of Spencer County.

Kentucky, Geol. Survey, John R. Proctor, Director, Report on Spencer and Nelson Counties, pp. 1-19. Map. [1888?]

Description of beds of the Hudson River group, accompanied by a colored geologic map.

— Geological Survey of Kentucky, John R. Proctor, Director. Report on the Geology of Washington County, 24 pages. Map. [1887?]

Description of Niagara and Trenton beds. Reference to structure and its relation to drainage. List of fossils. Accompanied by colored geologic map and section of Washington and Marion counties by W. M. Linney and W. T. Knott, respectively.

— Geological Survey of Kentucky, John R. Proctor, Director. Notes on the rocks of central Kentucky, with list of fossils, 19 pages. [Date?]

Review of stratigraphy of the Ordovician, Silurian, and Devonian formations and account of the flexures of the region. Incidentally considers equivalency of some of the Silurian and Ordovician members.

Liverpool Geological Association, Journal, vol. 8.

Arctic current and floating ice as factors in Canadian geology, GASKING.

LOCKINGTON, W. N. The neighborhood of Seville.

Am. Naturalist, vol. 23, pp. 165-166, 2 p. (February, 1889.)

Sketch of its geology.

LORD, N. W. Natural and artificial cements.

Ohio, Geol. Survey, Report, vol. 6, Economic Geology, pp. 671-695. 1888.

Includes reference to beds of hydraulic limestone, analyses of certain limestones, and an analysis of black shales from Columbus.

LOUGHRIDGE, R. H. Geological Survey of Kentucky, John R. Proctor, Director. Report on the geological and economic features of the Jackson purchase region, embracing the counties of Ballard, Calloway, Fulton, Graves, Hickman, McCracken, and Marshall, 357 pages. Plates. 3 maps in pocket. 1888.

Abstract [in regard to fault], Am. Jour. Sci., 3d series, vol. 37, p. 232, 11 lines. 1889.

Includes descriptions of formations from Cretaceous to recent and sub-Carboniferous and of the deep well and fault at Paducah. Discussion of equivalency, correlation, origin, extent, and relations of some of the formations and geologic history of the region at various stages. Analyses. Reference to relations and extent of Paleozoic border rocks in Missouri, Illinois, and Kentucky; agricultural features, distribution, composition, and characteristics of soils and clays. Descriptions of geology by counties. Accompanied by colored geologic map, map showing thickness of gravels, and a soil map.

Louisiana, iron ores, analyses, RIGGS.

iron regions, JOHNSON.

Petite Anse salt, BOLTON. COX. POMEROY.

relations of Grand Gulf series, HILGARD.

Tertiary, HEILPRIN. HILGARD.

LOVEJOY, Ellis. The Pomeroy and Federal Creek coal-field.

Ohio, Geol. Survey, Report, vol. 6, Economic Geology, pp. 627-652. Map. 1888.

Description of upper coal measures and upper barren measures.

LOW, A. P. Preliminary report on an exploration of country between Lake Winnipeg and Hudson Bay.

Canada, Geol. and Nat. Hist. Survey, Report, 1886, part F, pp. 1-19. 1887.

Abstract, Ibid., part A, pp. 26-28.

Includes pp. 17-18, notes of distribution and character of Laurentian, Huronian, lower Paleozoic limestone and drift. Reference to glacial striae.

LYMAN, Benjamin Smith. Geology of the Low Moor (Virginia) iron ores.

Am. Inst. Mining Engineers, Trans., vol. 14, pp. 801-809. 1886.

Describes structural relations and discusses the horizon of the feriferous stratum.

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McCHARLES, A. Notes on the geology of the Winnipeg district, Manitoba (Abstract).

Edinburgh Geol. Soc., Trans., vol. 5, pp. 331-333. 1887.

Gives section of drift and describes outcrops of fossiliferous Silurian and Ordovician.

— The foot-steps of time in the Red River Valley, with special reference to the salt springs and flowing wells to be found in it.

Manitoba, Hist. and Sci. Soc., Trans., No. 27, pp. 18. 1887.

Describes Archean, Ordovician, Silurian, Devonian, Cretaceous, and Quaternary formations.

McCONNELL, R. G. Report on the geological structure of a portion of the Rocky Mountains, accompanied by a section measured near the 51st parallel.

Canada, Geol. and Nat. Hist. Survey, Report, 1886, part D, pp. 41, pls. 2. 1887.

Abstract; *Ibid.*, part A, pp. 7-9, Geol. Magazine, 3d decade, vol. 6, pp. 133-134, ½ p. 1889.

Description of Cretaceous, and formations from Carboniferous to Cambrian; flexures and series of overthrust faults. Discussion of some stratigraphic and structural relations. Accompanied by plate of colored sections.

— Note on the geology of Mount Stephen, British Columbia.

Am. Geologist, vol. 3, pp. 22-25. 1889.

Description of stratigraphy and structure of the Mount Stephen region.

McCREATH, A. S., and D'INVILLIERS, E. V. Comparison of some Southern coals and iron ores.

Am. Inst. Mining Engineers, Trans., vol. 15, pp. 734-753. 1887.

Brief statement in regard to geologic relations at Birmingham, Alabama.

— Mineral resources of the upper Cumberland valley of southeastern Kentucky and southwestern Virginia tributary to the proposed Cumberland valley extension of the Louisville and Nashville railroad, 152 pages, map. Louisville, 1888.

Brief prefatory sketch of the general geology and structure, and detailed description of the coal measures.

— The New River—Cripple Creek mineral region of Virginia. See D'INVILLIERS, E. V., and.

McGEE, W J — Report.

U. S. Geol. Survey, Sixth Report, J. W. Powell, 1884-'85, pp. 25-32. 1885.

Account of geologic cartographic work of the Survey. Notice of studies of the terraces of the central eastern United States, and other investigations.

— Some features of the recent earthquake.

Sci. Am., Supt., vol. 23, pp. 9205-9206, No. 576. 1887.

From Science, vol. 8, pp. 271-275. 1886.

— *Ovibos cavifrons* from the loess of Iowa.

Am. Jour. Sci., 3d series, vol. 34, pp. 217-220. 1887.

Abstract, Am. Geologist, vol. 1, pp. 126-127, ½ p. 1887.

Discusses the climatic conditions of the loess period as indicated by its fauna; the relations of the loess to the drift in Iowa and adjacent regions; the early Quaternary submergence of the middle Atlantic slope, and the attendant climatic conditions; the extent of refrigeration in glacial times, and the position of the strata yielding the *Ovibos* remains at New Madrid and Fort Gibson.

— The Tuscaloosa formation. Summary of previous observations and opinions.

Tertiary and Cretaceous strata of Tuscaloosa, Tombigbee, and Alabama rivers, by E. A. Smith and L. C. Johnson, U. S. Geol. Survey, Bull., vol. 7, pp. 247-255. No. 43. 1887.

Discussion of age, correlation, and relations of Tuscaloosa and Potomac formations.

— Résumé.

Tertiary and Cretaceous strata of Tuscaloosa, Tombigbee, and Alabama rivers, by E. A. Smith and L. C. Johnson, U. S. Geol. Survey, Bull., vol. 7, pp. 285-290. No. 43. 1887.

References to characteristics, stratigraphy, and relations of the formations and sketch of their history.

— The geology of the head of Chesapeake Bay.

U. S. Geol. Survey, Seventh Report, J. W. Powell, 1885-'86, pp. 537-646, pls. 56-71. 1888.

Abstract, Am. Geologist, vol. 4, pp. 113-115. 1889.

Description and analysis of the physiography of the Chesapeake Bay region, and of the coastal plain in general; description of the Columbia and Potomac formations, and their relations in the various exposures, and discussion of their genesis, history, and taxonomy; synopsis of taxonomy of the glacial deposits.

McGEE, W J—Continued.

of the middle Atlantic slope; brief references to Archean (?) alluvial, Appomattox, and Sasfras River greensand; discussion of evidence of a displacement bounding the coastal plain on the west, its position, extent, amount, influence on drainage, and topography, date, history, rate, and cause; the genetic relations of topographic forms in general, and the Quaternary history recorded in the Columbia formation; and prognostication in regard to the occurrence of artesian waters in the region. Accompanied by a stereogram of the middle Atlantic slope.

— **Report — Potomac Division of Geology.**

U. S. Geol. Survey, *Seventh Report*, J. W. Powell, 1885-'86, pp. 104-111. 1888.

Includes a reference to the equivalency and history of the Potomac and Tuscaloosa formations.

— **Three formations of the Middle Atlantic Slope.**

Am. Jour. Sci., 3d series, vol. 35, pp. 120-143, 328-330, 367-388, 448-466, pls. II, VI, VII. 1888.

Abstract. Nature, vol. 33, p. 91, 15 lines, p. 190, 11 lines. 1888. *Am. Geologist*, vol. 2, pp. 129-131. 1888.

Description of character, distribution, and relations of the Potomac and Columbia formations, and of a new later Tertiary formation, designated the "Appomattox," from North Carolina to New Jersey. Discussion of stratigraphic relations, origin of materials, conditions of deposition, taxonomy, and bearing on geologic history, especially on the Quaternary. Synopsis of literature of the Columbia formation and of the glacial history of the United States. Accompanied by a stereogram of the middle Atlantic slope.

— **The classification of geographic forms by genesis.**

National Geogr. Mag., vol. 1, pp. 27-36. 1888.

Definition and classification of geologic phenomena and discussion of their relation to the genesis of geographic features.

— **The Columbia formation.**

Am. Assoc. Adv. Science, Proc., vol. 33, pp. 231-232. 1888.

General notice. Discussion of origin and mode of deposition of its materials and climatic conditions indicated by its stratigraphy and relations.

— **Paleolithic man in America: his antiquity and environment.**

Popular Science Monthly, vol. 34, pp. 20-36. 1888.

Includes a sketch of the glacial history of North America, especially of the lower Dela-

McGEE, W J—Continued.

ware Valley and the relations of the Trenton gravels.

— **[On some peculiarities of the superficial deposits of northeastern Iowa.]**

Am. Geologist, vol. 2, pp. 137-138, $\frac{1}{2}$ p. 1888.

Brief reference to forest bed intercalated between the drifts, the occurrence of kames and asar, the distribution of the loess, and certain anomalous relations of the drainage.

— **Notes on the geology of Macon County, Missouri.**

St. Louis, Acad. Sci., Trans., vol. 5, pp. 305-336. 1888.

Description of topography, the alluvial, aquo-glacial and glacial deposits, the Carboniferous rocks and coals, and structure. Discussion of classification of plains, sketch of Pleistocene history, and correlation of coalbeds and of the strata pierced by drill-holes.

— **Topographic types of northeastern Iowa.**

Am. Naturalist, vol. 23, p. 808, $\frac{1}{2}$ p. 1889.

Abstract of paper read to American Association, 1889. The abstract consists of an account of some characteristics of the drainage systems.

— **Geological antecedents of man in the Potomac valley.**

Am. Anthropologist, vol. 2, pp. 227-234. 1889.

Comprises a brief sketch of the Potomac and Pleistocene history of the Middle Atlantic slope.

McINNES, W. Portions of counties of New Brunswick. See **BAILEY, L. W.**, and.

McKELLAR, Peter. The correlation of the Animikie and Huronian rocks of Lake Superior.

Canada, Royal Soc., Trans., vol. 5, section IV, pp. 63-73. 4°. 1888.

Description and discussion of characteristics, structure, and contact relations, and discussion of equivalency and history of the Huronian, Animikie, Keweenawan, "Nipigon," and overlapping formations in the Lake Superior regions. Reference to relations of Huronian and Laurentian.

McRAE, John C. The geological formation at Port Colborne as shown by drilling for natural gas.

Canadian Inst., Proc., vol. 6 (new series), pp. 338-341. 1889.

Gives 1,500-foot well record and a north and south section through the Niagara peninsula, from Lake Ontario to Lake Erie.

[**MacFARLANE**, Thomas.] [On the use of the term "Taconic."]

International Congress of Geologists, Am. Committee, Report, 1888, B, p. 17, 3 lines.

Am. Geologist, vol. 2, p. 207. 1888.

Reference to its application to some pre-Cambrian rocks.

— On the Archean. See **FRAZER**, Report on Archean.

Maine, Aroostook County, **BAILEY**.

boulder deposits, **CHAMBERLIN**.

enlargements of augites in peridotites from Little Deer Island, **MERRILL**, G. P.

Farmingham clay, **ROBINSON**.

glaciation of mountains, **UPHAM**.

osar and moraine, **CHAMBERLIN**.

Paleozoic and volcanic series near Eastport, **SHALER**.

post glacial history and volcanic ash-beds on coast, **SHALER**.

relations between geology of Maine and New Brunswick, **BAILEY**.

Silurian system of northern, **BAILEY**. terminal moraines, **STONE**.

Manchester Geological Society, Transactions, vol. 19.

Richmond coal-field, Virginia, **CLIFFORD**.

Manitoba, Historical and Scientific Society, Transactions, No. 27.

Red River Valley geology, **McCHARLES**.

MARCOU, Jules. On the use of the name Taconic.

Boston Soc. Nat. Hist., Proc., vol. 23, pp. 343-355. 1887.

A plea for the retention of "Taconic" as a group name for the primordial, and the relegation of Cambrian to the rocks of the second fauna instead of "Ordovician." Discusses the history of "Taconic," and gives a table showing the classification of the lower Paleozoic according to Sedgwick, Murchison, Emmons, Barrande, Marcou, Lapworth, and Walcott, and a list of papers on the subject.

— Paleontologic and stratigraphic "principles" of the adversaries of the Taconic.

Am. Geologist, vol. 2, pp. 10-23, 67-88. 1888.

Discussion of paleontologic, stratigraphic, and structural relations of the Taconic system, especially in review of C. D. Walcott's paper, "The Taconic system of Emmons, and the use of the name Taconic in geologic nomenclature."

MARCOU, Jules—Continued.

— Geology of the vicinity of Quebec city.

Am. Geologist, vol. 2, pp. 355-356. 1888.

References to horizon, and relations of alates unconformably underlying the Trenton at Quebec and Montmorenci falls.

— The Taconic of Georgia, and the report on the geology of Vermont.

Boston Soc. Nat. Hist., Memoirs, vol. 4, pp. 105-131, pl. 13. 4^o. 1888.

Abstract, Am. Geologist, vol. 1, pp. 328-329, § p. 1888.

Consists of a discussion of the relations in northwestern Vermont and the Quebec region, the Lorraine shales versus the Hudson River group, the horizons of the graptolitic zone of eastern America, the classification and nomenclature of the geology of Vermont, the history of Emmons's map of New York, and the history, classification, and use of the name "Georgia."

— Some remarks on Prof. Henry S. Williams's report of the subcommittee on the upper Paleozoic (Devonic) in the American Geologist for October, p. 226.

Am. Geologist, vol. 3, pp. 60-61. 1889.

Discussion of some points in the history of the nomenclature of the New York Devonian.

— Barrande and the Taconic system.

Am. Geologist, vol. 3, pp. 118-137. 1889.

Historic and controversial.

— The original locality of the Gryphæa Pitcheri, **MORTON**.

Am. Geologist, vol. 3, pp. 188-193. 1889.

Includes a discussion of the absence of Neocomian in New Mexico and reference to the extent of the Jurassic formation of the Tuncucari area of Texas.

— The Mesozoic series of New Mexico.

Am. Geologist, vol. 4, pp. 155-165, 216-229. 1889.

Reviews the investigations of Marcou, Newberry, Le Conte, Hayden, and Stevenson, and discusses the classification of the New Mexican and Texan Mesozoic series.

— Jura Neocomian and chalk of Arkansas.

Am. Geologist, vol. 4, pp. 357-367. 1889.

Review of R. T. Hill on the "Neozoic Geology of Southwestern Arkansas." Discusses the general stratigraphic statements concerning the Mesozoic formations, and reviews the paleontology and equivalency of the Trinity and Cretaceous.

— On some dates of the "Report on the Geology of Vermont."

MARCOU, Jules—Continued.

Boston Soc. Nat. Hist., Proc., vol. 24, pp. 83-89. 1889.

Review of various historic questions concerning the Taconic in Vermont publications.

MARGARIE, Emm. de. Presentation d'un relief en plâtre de la Pennsylvanie au nom de M. J. P. Lesley et observations sur les plissements des terrains paléozoïques.

Soc. Géol. de France, Bull., 3d series, tome 15, pp. 356-357. 1887.

Discusses the plications of an area in central Pennsylvania; as exhibited by a stereogram of the flexures at the surface of the "Medina" sandstone.

MARSH, O. C. Notice of a new genus of Sauropoda and other new Dinosauria from the Potomac formation.

Am. Jour. Sci., 3d series, vol. 35, pp. 88-94. 1888.

Abstract, Am. Geologist, vol. 1, p. 136, $\frac{1}{2}$ p. 1888.

Includes a brief reference to the uncertainties in regard to the age indicated by these fossils.

— Restoration of *Brontops robustus*, from the Miocene of America.

Am. Jour. Sci., 3d series, vol. 37, pp. 163-165, pl. VI. 1889.

Includes very brief reference to subdivisibility of *Brontotherium* beds of the eastern flanks of the Rocky Mountains.

— The skull of the gigantic *Ceratopsidæ*.

Am. Jour. Sci., vol. 38, pp. 501-506, plate XII. 1889.

Includes a reference to the geologic horizon of the "*Ceratops* bed" and its persistence for many hundred miles along the east flank of the Rocky Mountains.

MARSTERS, V. F. On certain camp-tonite dikes near Whitehall, Washington County, New York. See **KEMP, J. F.**, and.**MARTIN, D. S.** The "Field of rocks" [11 miles west of Philadelphia].

New York Acad. Sci., Trans., vol. 7, pp. 16-18. 1888.

Description of isolated boulder-covered areas, and suggestion in regard to the origin of the boulders.

— [Remarks on the distinctness of the New York gneiss from the crystalline rocks of the Highlands.]

New York Acad. Sci., Trans., vol. 7, p. 64, $\frac{1}{2}$ p. 1888.

MARTIN, D. S.—Continued.

— Geological map of New York City and vicinity, 2 miles to 1 inch. New York, 1888. Accompanied by an explanatory text, pp. 14.

A colored wall-map, showing areal distribution of geologic formations within a radius of 40 miles from New York. The accompanying pamphlet gives a brief general account of geologic relations of the region.

Maryland Academy of Sciences, Transactions, vol. 1.

Cretaceous and Eocene of Maryland, UHLER.

Maryland, age of Potomac formation, WARD.

Antecedents of man in the Potomac valley, MCGEE.

Albirepean and associated formations, HEILPRIN. LEWIS, H. C. UHLER.

Archean geology, WILLIAMS, G. H. Baltimore gabbros, WILLIAMS, G. H. coal, ASHBURNER.

Columbia formation, MCGEE.

Cretaceous in Ann Arundel and Prince George counties, CLARK.

Cretaceous of southwest Maryland, BRYAN.

Eocene and Cretaceous, UHLER.

excursions into southern counties, CLARK.

geology of the Baltimore region, WILLIAMS, G. H.

geology of head of Chesapeake Bay, MCGEE.

infusorial earth, DAY.

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— and **JOHNSON**, Lawrence C. Tertiary and Cretaceous strata of the Tuscaloosa, Tombigbee, and Alabama rivers.*U. S. Geol. Survey, Bull.*, vol. 7, pp. 153-341, pls. I-XXI. No. 43. 1887.**SMITH**, Eugene A., and **JOHNSON**, Lawrence C.—Continued.Abstracts, *Am. Geologist*, vol. 4, pp. 182-191, 1889; *Am. Naturalist*, vol. 24, pp. 164-165, 1890.

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 drifts of Great Britain. List of papers.

— The recession of the ice sheet in
 Minnesota in its relation to the gravel
 deposits overlying the quartz imple-
 ments found by Miss Babbitt at Little
 Falls, Minnesota.

Boston Soc. Nat. Hist., Proc., vol. 23, pp.
 436-447. 1888.

Description of the relations of the contain-
 ing gravels and a sketch of the history of the
 ice-sheet recession in the Minnesota region.

UPHAM, Warren—Continued.

— The geology of Carver and Scott
 counties.

Minnesota, Geology of, Final Report, vol.
 2, pp. 102-147, map. 1888.

Description of Cambrian and Cretaceous
 areas and the drifts. Artesian well records;
 terraces. Discussion of the relations and
 origin of some of the drifts, and the history
 of some ancient drainage features. Accom-
 panied by a colored geologic map.

— The geology of Sibley and Nicollet
 counties.

Minnesota, Geology of, Final Report, vol.
 2, pp. 148-179, map. 1888.

Descriptions of drifts, terraces and out-
 crops of Archean, Cambrian, and Cretaceous.
 Discussion of equivalency of some of the
 Cambrian members and the relation and ori-
 gin of some of the drifts. Accompanied by
 a colored geologic map.

— The geology of McLeod County.

Minnesota, Geology of, Final Report, vol.
 2, pp. 180-189. Map. 1888.

Description of the drifts, and discussion of
 the relations and origin of some of their fea-
 tures. Accompanied by a colored geologic
 map.

— The geology of Renville County.

Minnesota, Geology of, Final Report, vol.
 2, pp. 190-204. Map. 1888.

Description of drifts, Archean, Cretaceous,
 terraces, and interglacial forest bed. Accom-
 panied by a colored geologic map.

— The geology of Swift and Chippewa
 counties.

Minnesota, Geology of, Final Report, vol.
 2, pp. 205-219. Map. 1888.

Description of drifts, Archean outcrops,
 buried moraine, preglacial drainage channels,
 and terraces. Accompanied by a colored
 geologic map.

— The geology of Kandiyohi and
 Meeker counties.

Minnesota, Geology of, Final Report, vol.
 2, pp. 220-242. Map. 1888.

Description of drifts, and sketches of glacial
 history. Accompanied by a colored geologic
 map.

— The geology of Wright County.

Minnesota, Geology of, Final Report, vol.
 2, pp. 243-263. Map. 1888.

Description of drifts and doubtful Creta-
 ceous outcrops. Discussions of the relations
 of some of the drifts, and some features of
 glacial history. Accompanied by a colored
 geologic map.

— The geology of Chisago, Isanti, and
 Anoka counties.

UPHAM, Warren—Continued.

Minnesota, *Geology of, Final Report*, vol. 2, pp. 399-425. Map. 1888.

Description of drifts, terraces, and of outcrops of traps, St. Croix sandstone, lower magnesian limestone, and Treuton limestone. Discussion of the relations and origin of some of the drifts. Accompanied by a colored geologic map.

— The geology of Benton and Sherburne counties.

Minnesota, *Geology of, Final Report*, vol. 2, pp. 426-444. Map. 1888.

Description of Archean areas, trap dikes, and drifts. Discusses relations of some of the drifts. Accompanied by a colored geologic map.

— The geology of Stearns County.

Minnesota, *Geology of, Final Report*, vol. 2, pp. 445-470. Map. 1888.

Description of drifts, Archean and Cretaceous, and sketch of glacial history. Accompanied by a colored geologic map.

— The geology of Douglas and Pope counties.

Minnesota, *Geology of, Final Report*, vol. 2, pp. 471-498. Map. 1888.

Description of drifts. References to glacial history indicated by some of the features, relations of the drifts, and preglacial topographic features; presence of Cretaceous. Accompanied by a colored geologic map.

— The geology of Grant and Stevens counties.

Minnesota, *Geology of, Final Report*, vol. 2, pp. 499-510. Map. 1888.

Description of drifts and beaches of glacial Lake Agassiz. Accompanied by a colored geologic map.

— The geology of Wilkins and Traverse counties.

Minnesota, *Geology of, Final Report*, vol. 2, pp. 511-533. Map. 1888.

Description of shore phenomena, and sketch of history of glacial Lake Agassiz. Reference to underlying Cretaceous found in well at Fargo. Accompanied by a colored geologic map.

— The geology of Ottertail County.

Minnesota, *Geology of, Final Report*, vol. 2, pp. 534-561. Map. 1888.

Description of drifts and beaches of Lake Agassiz. Discussion of nature of underlying rocks, and the origins of some of the drift deposits. Accompanied by a colored geologic map.

— The geology of Wadena and Todd counties.

Minnesota, *Geology of, Final Report*, vol. 2, pp. 562-579. Map. 1888.

UPHAM, Warren—Continued.

Description of drifts, Archean, and diorite. Discussion of the nature and sequence of some of the glacial phenomena. Accompanied by a colored geologic map.

— The geology of Crow Wing and Morrison counties.

Minnesota, *Geology of, Final Report*, vol. 2, pp. 580-611. Map. 1888.

Description of drifts, Archean, staurolitic and mica schists, and Cretaceous. Discusses origin of some of the drift materials. Some copies accompanied by a colored geologic map.

— The geology of Mille Lacs and Kanabec counties.

Minnesota, *Geology of, Final Report*, vol. 2, pp. 612-628. Map. 1888.

Description of drifts, and Archean and Potsdam outcrops. Accompanied by a colored geologic map.

— The geology of Pine County.

Minnesota, *Geology of, Final Report*, vol. 2, pp. 629-645. Map. 1888.

Description of drifts, Archean, Keweenawan, and Cambrian outcrops, and ancient outlet of Lake Superior. Accompanied by a colored geologic map.

— The geology of Becker County.

Minnesota, *Geology of, Final Report*, vol. 2, pp. 646-655. Map. 1888.

Description of drifts, and discussion of extent and relation of underlying rocks. Accompanied by colored geologic map.

— The geology of Clay County.

Minnesota, *Geology of, Final Report*, vol. 2, pp. 656-671. Map. 1888.

Description of drifts and shore phenomena of glacial Lake Agassiz. References to preglacial topography, and well at Fargo into supposed Cretaceous strata. Accompanied by a colored geologic map.

— Glaciation of mountains in New England and New York.

Am. Geologist, vol. 4, pp. 165-174, 205-216. 1889.

Appalachia, vol. 5, pp. 291-312. 1889.

Discusses the extent, thickness, direction of movement, and action on elevated regions of the great ice caps of the glacial period.

— Ascents of Camel's Hump and Lincoln Mountain, Vermont.

Appalachia, vol. 5, pp. 319-326. 1889.

Includes some brief references to the characteristics of the rocks, evidences of glaciation, and glacial drifts.

— Marine shells and fragments of shells in the till near Boston.

UPHAM, Warren—Continued.

Boston Soc. Nat. Hist., Proc., vol. 24, pp. 127-141. 1889.

Am. Jour. Sci., vol. 37, pp. 359-372. 1889.

Abstracts, Nature, vol. 40, p. 68, 11 lines, 1889; Am. Geologist, vol. 3, p. 399, $\frac{1}{2}$ p. 1889.

Summary account of the various localities; description of deposits in which the shells occur, discussion of their transportation, and their bearing on the recency of the glacial period, late preglacial climatic conditions and height of sea level, and a general review of the evidence bearing on the cause, nature, and amounts of post-glacial submergence in eastern North America.

— [Age and origin of the pot-holes at Cohasset.]

Boston Soc. Nat. Hist., Proc., vol. 24, pp. 226-228. 1889.

Includes reference to some other pot-holes of supposed glacial origin.

— The structure of drumlins.

Boston Soc. Nat. Hist., Proc., vol. 24, pp. 228-242. 1889.

Abstract, Am. Geologist, vol. 5, p. 61, $\frac{1}{2}$ p.

Detailed description of several drumlins in eastern Massachusetts, and discussion of their relations and history.

— The glacial moraines of Minnesota.

Minnesota Acad. Sci., Bull., vol. 3, part 1, p. 12, $\frac{1}{2}$ p. 1889.

Short notice of paper. Classified list of moraines, and statement in regard to their lateral nature.

— Changes in the currents of the ice of the last glacial epoch in eastern Minnesota.

Minnesota Acad. Sci., Bull., vol. 3, part 1, pp. 51-56. 1889.

Discussion of the history and results of the

UPHAM, Warren—Continued.

glacial flows, and of evidence of the existence of certain glacial rivers in the region.

— Description of maps showing the climate, geography, and geology of Minnesota.

Minnesota Acad. Sci., Bull., vol. 3, part 1, pp. 151-155. 1889.

Includes a general account of the characteristics and distribution of formations in Minnesota.

— [Beaches of Lake Agassiz.] See **CHAMBERLIN**, Division of glacial geology.

Utah, Cambrian, MATTHEW. WALCOTT. coal, ASHBURNER.

fossils from San Pete region, WHITE, C. A.

gilsonite, Uinta County, RAYMOND.

gold and silver mining, HOLLISTER.

Henry Mountain laccolites, CROSS.

EMMONS, S. F.

iron ore of southern Utah, BLAKE.

Laramie, WARD. WHITE, C. A.

marbles, NEWBERRY.

mountain upthrusts, Uinta, etc., WHITE, C. A.

obsidian, IDDIGS.

old Telegraph mine, LAVAGNINO.

Permian of Texas, HILL, R. T.

relations of Laramie, WHITE, C. A.

stratigraphic position of Olenellus, WALCOTT.

structural relations of ore deposits,

EMMONS, S. F.

sulphur deposits, FAUR.

upper Eocene formation, SCOTT.

V.

VAN DIEST, P. H. Notes on some Boulder County veins.

Colorado Sci. Soc., Proc., vol. 2, part 2, pp. 50-55, plate. 1887.

Describes the gneisses, granites, felsite dikes, and their contained minerals. On accompanying map indicates boundary of metamorphic and sedimentary rocks.

— Address of the retiring president.

Colorado Sci. Soc., Proc., vol. 2, pp. 278-285. 1888.

Refers to geologic features of Caribou Mountains, and at the Wilson mine, Idaho, in connection with the occurrence of gold at these localities.

— Colorado volcanic craters.

Colorado Sci. Soc., Proc., vol. 3, pp. 19-24. 1889.

VAN DIEST, P. H.—Continued.

Describes some features of craters and lava flows in Rio Grande County, and refers to reports of craters at other points in Colorado.

VAN HISE, C. R. Notes on the enlargement of hornblendes and augites in fragmental and eruptive rocks.

Am. Jour. Sci., 3d series, vol. 33, pp. 385-388. 1887.

Abstract, Am. Naturalist, vol. 22, p. 168, $\frac{1}{2}$ p. 1888.

Calls attention to Becke's discovery of the fact in 1883, and describes some Penokee-Gogebic altered diabbases exhibiting secondary hornblende enlargements on augite grains.

— The iron ores of the Penokee-Gogebic series of Michigan and Wisconsin.

VAN HISE, C. R.—Continued.

Am. Jour. Sci., 3d series, vol. 37, pp. 32-48, pl. 2. 1889.

Abstracts, *Nature*, vol. 39, p. 310, 8 lines, 1889; *Am. Geologist*, vol. 3, pp. 197-198, 1889.

Brief account of geology of Penokee-Gogebic region, description of relations of ore deposits and associated intrusive rocks, and discussion of the genesis of the ores.

— The chemical origin of the Vermilion Lake iron ores.

Am. Geologist, vol. 4, pp. 382-383. 1889.

Review of N. H. and H. V. Winchell "On a possible chemical origin of the iron ores of the Keewatin in Minnesota." Incidentally discusses the history of the discovery of unconformity at the base of the Keewatin series, and the correlation of some of the formations which are included in the Keewatin series.

VAN NESS, W. W. J. Tin in North Carolina.

Eng. and Mining Jour., vol. 44, p. 344, 1 p. 1887.

General description of geology of King's Mountain region.

Vassar Brothers' Institute, Transactions, vol. 4.

Cutting at Croton Point, New York, WARRING.

Evolution of continents, WARRING.

Plication in continental elevation, DWIGHT.

Primordial of Wappinger Valley limestone region, DWIGHT.

Vermont, great primordial quartzite, WINCHELL, N. H.

Camel's Hump and Mount Lincoln, UPHAM.

conglomerates in gneisses, HITCHCOCK.

date of Report on Geology of Vermont, HITCHCOCK.

fossils in lower Taconic of Emmons, WALCOTT.

glaciation of mountains, UPHAM.

principles of adversaries of the Taconic, MARCOU.

Taconic of Georgia, and Report on Geology of Vermont, MARCOU.

Taconic question restated, HUNT.

Taconic system of Emmons, MILLER, WALCOTT.

new locality of camptonite, NASON.

Virginia, age of Potomac formation, WARD.

antecedents of man in the Potomac valley, MCGEE.

Virginia—Continued.

coal, ASHBURNER.

coal-field of southwestern Virginia, KILLEBREW.

Columbia formation, MCGEE.

faults of southwestern Virginia, STEVENSON.

flora of older Mesozoic, STUR.

gas and coal, Chesterfield County, RUSSELL, I. C.

Glenmore iron estate, Greenbrier County, PAGE.

iron ore, Rockbridge County.

lower Carboniferous, STEVENSON.

Low Moor iron ore, LYMAN.

mineral resources of southwestern Virginia, PROCTOR.

Natural Bridge, Balcony Falls, Luray, Great Valley, BRITTON.

natural coke from Midlothian, analysis, RIGGS.

New River-Cripple Creek region, D'INVILLIERS and MCCREATH.

Oriskany boulder near Washington, District of Columbia, CURTICE.

reconnaissance in southwestern Virginia, STEVENSON.

Richmond coal - field, CLIFFORD. NEWELL.

surface geology of southwestern Virginia, STEVENSON.

sauroptera from the Potomac formation, MARSH.

terraces, MCGEE. STEVENSON. WHITE, I. C.

three formations of the middle Atlantic coast, MCGEE.

Trenton limestone from Lexington; analysis, RIGGS.

upper Cumberland valley, MCCREATH and D'INVILLIERS.

[younger Mesozoic from Richmond southward], WARD.

VOGDES, Anthony W. Some forgotten Taconic literature.

Am. Geologist, vol. 2, pp. 352-355. 1888.

Descriptive notes and abstracts of papers by Dewey in 1819 and 1824, and Emmons, 1842 and 1846.

— The genera and species of North American Carboniferous trilobites.

New York Acad. Sci., Annals, vol. 4, pp. 69-105, pls. II, III. 1888.

Includes a general sketch of the distribution of the Carboniferous members in the United States, pp. 70-74.

W.

WADSWORTH, M. E. Preliminary description of the peridotites, gabbros, diabases, and andesytes of Minnesota.

Geol. and Nat. Hist. Survey of Minnesota, Bull. No. 2, pp. 9-159, 12 plates. 8°. St. Paul, 1887.

Abstract, *Am. Naturalist*, vol. 22, pp. 452-453, $\frac{1}{2}$ p. 1888.

Description and discussion of the micro-petrography of a large collection in greater part from the northeastern part of the State. Colored plates of micro rock sections.

Also includes a discussion of classification, history, and relations of basic crystalline rocks.

— The Keweenaw system.

Science, vol. 10, p. 166, $\frac{1}{2}$ p. 1887.

Describes a locality on the Hungarian River; a gradation of the eastern sandstone into the Keweenaw rocks is exhibited without intervening fault. Discusses the copper-bearing rocks and relative position of the sandstones.

— [On subdivisions, unconformities, characteristics, origin of some members, nomenclature, and life of the Archean, and origin of serpentine.]

International Congress of Geologists, Am. Committee Reports, 1888, A, pp. 69-70.

Wagner Free Institute, Transactions, vol. 1.

Explorations on west coast of Florida, etc., HEILPRIN.

WALCOTT, Charles D. Report * * * Division of Paleozoic Invertebrates.

U. S. Geol. Survey, Sixth Annual Report, 1884-'85, pp. 74-78. 1885.

Notice of Paleozoic rocks of central Texas and Devonian fossils from northern Montana.

— The Taconic system.

Am. Jour. Sci., 3d series, vol. 33, pp. 153-154. 1887.

Announces results of recent field work in Taconic region which indicates: 1. That the granular quartz is the shore deposit of the shales, sandstones, and limestones of the "upper Taconic and is Middle Cambrian in age," and 2. That the Potsdam is represented by the base of the limestone on the eastern side and by hydromica shales on the west side of the range; the limestones and overlying slates of the Taconic range representing the calciferous and Hudson River groups, as shown by Dana.

— Fauna of the "upper Taconic" of Emmons, in Washington County, New York.

WALCOTT, Charles D.—Continued.

Am. Jour. Sci., 3d series, vol. 34, pp. 187-199, plate 1. 1887.

Statement of stratigraphic position and account of mode of occurrence.

— Section of lower Silurian (Ordovician) and Cambrian strata in central New York, as shown by a deep well near Utica. [Abstract.]

Am. Assoc. Adv. Science, Proc., vol. 36, pp. 211-212, $\frac{1}{2}$ p. 1888.

Description of drill-hole 2,250 feet in depth.

— Discovery of fossils in the lower Taconic of Emmons. [Abstract.]

Am. Assoc. Adv. Science, Proc., vol. 36, pp. 212-213. 1888.

Describes occurrences of middle Cambrian species in the quartzites and Trenton-Chazy species in the limestones of southwestern Vermont, and calls attention to their bearing on the question of the age of the Taconic system.

— The Taconic system of Emmons, and the use of the name Taconic in geologic nomenclature.

Am. Jour. Sci., 3d series, vol. 35, pp. 229-242, pl. III, pp. 307-327, 394-401. 1888.

Abstract, *Nature*, vol. 37, p. 500, 14 lines; p. 623, 11 lines. 1888.

Review by Jules Marcou, *Am. Geologist*, vol. 2, pp. 10-23, 67-88. 1888.

Review of Emmons and others, description and discussion of relations in the Taconic region, announcement of discovery of fossils and structural features throwing new light on the relative position, equivalency, and relations of the various members of the Taconic system, discussion of nomenclature and classification of the Cambrian formations. Accompanied by a colored geologic map.

— Cambrian fossils from Mount Stephen, Northwest Territory of Canada.

Am. Jour. Sci., 3d series, vol. 36, pp. 161-166, September number. 1888.

Read to Biological Society of Washington, 1888.

Review of some of the species described by Rominger, and discussion of the paleontologic evidence on the stratigraphic position of the Cambrian of Mount Stephen.

— [On the nomenclature and origin of the Archean and the use of the term Taconic.]

International Congress of Geologists, Am. Committee Reports, 1888, A, pp. 57-58.

— Synopsis of conclusions on the "Taconic system" of Emmons.

WALCOTT, Charles D.—Continued.

International Congress of Geologists, Am. Committee Reports, 1888, B, pp. 25-29.

Am. Geologist, vol. 2, pp. 215-219. 1888.

Extracts from paper in American Journal of Science, 1888, with additional notes.

— Report—Paleozoic division of invertebrate paleontology.

U. S. Geol. Survey, Seventh Report, J. W. Powell, 1885-'86, pp. 113-117. 1888.

Reference to the formations constituting the Paleozoic in central Nevada, especially to the discovery of Devonian and lower Carboniferous; the thickness and horizon of the Wahsatch Cambrian; to studies by H. S. Williams on the stratigraphy and faunal relations of the Devonian of southern New York; and collection of Cambrian fossils in the southern Appalachian by Cooper Curtice.

— Stratigraphic position of the Olenellus faunæ of North America and Europe.

Am. Jour. Sci., 3d series, vol. 37, pp. 374-392, vol. 38, pp. 29-42. 1889.

Abstracts, Nature, vol. 40, pp. 68, 310-311, 24 lines, 1889. New York Acad. Sci., Trans., vol. 8, p. 176, $\frac{1}{2}$ p. 1889.

Review and discussion of paleontologic and stratigraphic relations of the lower Cambrian to the middle Cambrian, and of the stratigraphic position, geographic distribution, zoology and stratigraphic characteristics of the Olenellus zone in America and Europe. Includes a description of the Cambrian of Newfoundland based on recent examinations, and a general review and tabulation of Cambrian taxonomy.

— A simple method of measuring the thickness of inclined strata.

U. S. National Museum, Proc., vol. 11, pp. 447-448. 1889.

WALKER, J. B. Notes on the geology of Burnet County.

Geol. and Sci., Bull., vol. 1, February, 1889. 4°.

Statements in regard to characteristics, relations, and distribution of the Cretaceous and Carboniferous.

WARD, Lester F. Synopsis of the flora of the Laramie group.

U. S. Geol. Survey, Sixth Report, J. W. Powell, 1884-'85, pp. 399-557, pls. III-LXV. 1885.

Abstracts, Am. Naturalist, vol. 21, pp. 1011-1012; Am. Geologist, vol. 2, pp. 56-58, 1888.

Review, Science, vol. 10, pp. 150-151. 1887.

Reviews the opinions which have been held in regard to the age and position of the Laramie and equivalent formations. Describes the nature, extent, and vegetation of the group and discusses its age, history, distribu-

BULL. 75—11

WARD, Lester F.—Continued.

tion, and floral relations, the equivalency of groups near its horizon, and the stratigraphic and geographic range of the flora of the Laramie, Senonian, and Eocene. Gives a brief account of observation on the lower Tertiary or upper Cretaceous at several points in Colorado and Wyoming, and along the Missouri from Fort Benton to Bismarck.

— Evidence of the fossil plants as to the age of the Potomac formation.

Am. Jour. Sci., 3d series, vol. 36, pp. 119-131. 1888.

Abstract, Nature, vol. 38, p. 462, 9 lines. 1888. Read to National Academy of Sciences, 1888.

— Report—Division of paleobotany.

U. S. Geol. Survey, Seventh Report, J. W. Powell, 1885-'86, pp. 123-126. 1888.

Includes a brief reference to the occurrence of outcrops of younger Mesozoic from Richmond southward, and at Weldon, North Carolina.

WARDROP, D. Lee. The formation of coal beds.

Eng. and Mining Jour., vol. 45, p. 473, $\frac{1}{2}$ col., 4°. 1888.

Describes occurrence of small lenticular coal masses in sandstone over coal beds in northwestern Georgia.

WARRING, Charles B. The cutting at Croton Point, New York.

Vassar Brothers' Inst., Trans., vol. 4, pp. 274-278. 1887.

Describes and figures beds of sand and cobbles unconformably overlain by two layers of very fine material conformable to the surface of the ground, on Hudson River just north of the mouth of the Croton River.

— The evolution of continents.

Vassar Brothers' Inst., Trans., vol. 4, pp. 256-271, 273-274. 1887.

General discussion of the relations of continental masses; the theories of continental formation and the solidification of the earth's crust. Advances the hypothesis that the continents originally constituted a great triangular clot of solidified matter floating on a molten surface, and by breaking apart near the central line at the present Atlantic Ocean, separated into continents which were thence solidified into their present positions.

Washburn College Laboratory, Bulletin, vol. 2.

Paleontology of the Plains, CRAGIN. Region south of great bend of the Arkansas, CRAGIN.

Washington, analysis of soil, SCHNEIDER.

Washington—Continued.

changes in river courses due to glaciation, WILLIS.

coal, ASHBURNER.

glaciation of Pacific coast, WRIGHT.

invertebrate fossils from Pacific coast, WHITE, C. A.

Mount Ranier and the glaciers, WILLIS.

Puget group, WHITE, C. A.

transcontinental railways, LANG.

structure of northern Washington, WILLIS.

Washington, Philosophical Society, Bulletin, vol. 9.

Faults of Great Basin, etc., RUSSELL.

Geologic history of Sierra Nevada, GILBERT.

Geology of northern California, DILLER.

Sierra structure not extended into Washington, WILLIS.

— vol. 10.

Mount Ranier and its glaciers, WILLIS.

— vol. 11.

Problems of physical geology, DUTTON.

Crystallization of igneous rocks, IDDINGS.

WASMUTH, Henry A. Studies on the stratification of the anthracite measures of Pennsylvania.

Franklin Inst. Jour., vol. 124, pp. 109-126, 4 plates. 1887.

Abstract, *Am. Naturalist*, vol. 24, p. 768, $\frac{1}{2}$ p. 1890.

Discusses relations of flexures to faults and the occurrence and causes of offsets in some of the collieries of the anthracite region.

— Notes on the Pittsburg coal bed and its disturbances.

Am. Geologist, vol. 1, pp. 272-277. 1888.

Description and discussion of flexures and faults at Biddle, Westmoreland County, Pennsylvania.

— Notes on the structural geology of the Carboniferous formation of Pennsylvania.

Am. Geologist, vol. 2, pp. 311-323. 1888.

Discussion of the structural relations of the coal beds in the Pittsburg and in the anthracite regions.

— The southern anthracite coal field of Pennsylvania—its enormous distur-

WASMUTH, Henry A.—Continued.

bances and consequent premature exhaustion.

Franklin Inst. Jour., vol. 125, pp. 110-114. 1888.

Reference to faults and steep folds indicating the existence of much greater disturbance than is shown on the geological survey maps.

WEBER, Adolph H. Natural gas.

California, Seventh Report of State Mineralogist, pp. 181-191. 1888.

Section in superficial deposits at Eureka; notice of occurrences of lignite at various points in Humboldt, Trinity, Tehama, Mendocino, Sonoma, Colusa, and Shasta counties.

— Petroleum and asphaltum in northern California.

California, Seventh Report of State Mineralogist, pp. 195-202. 1888.

Gives sections on coast south of Bear River and at Point Arena showing relations of bituminous beds.

WEBSTER, Clement L. On the glacial flow in Iowa.

Am. Naturalist, vol. 21, pp. 758-761. 1887.

Discusses the evidence of three ice flows. Describes striae, the drift, and the inner and outer moraines of the last two glacial advances.

— Notes on the geology of Johnson County, Iowa.

Am. Naturalist, vol. 22, pp. 408-419, pl. 5. 1888.

Description of pot-holes and old river channel in Devonian limestone at its overlap by the Carboniferous; peat beds under the drift at various points in Iowa; terraces along Iowa River; loess and drift. Brief discussion of age, origin, and conditions of deposition of the loess.

— Notes on the Rockford shales.

Am. Naturalist, vol. 23, pp. 444-446. 1888.

Reference to lithologic and paleontologic variations at different localities, and description of fossils from Owens's Grove, Cerro Gordo County.

— On the glacial drift and loess of a portion of the northern-central basin of Iowa.

Am. Naturalist, vol. 22, pp. 972-979. 1888.

Drifts, loess, vegetal beds between drift sheets, distribution of erratics, terraces, relation of drainage to structure.

— Description of new species of fossils from the Rockford shales of Iowa.

Am. Naturalist, vol. 22, pp. 1013-1018. 1888.

Reference to the great variety of conditions of deposition indicated in the Devonian of

WEBSTER, Clement L.—Continued.

Iowa, and the effects upon the faunal relations.

- A general preliminary description of the Devonian rocks of Iowa, which constitute a typical section of the Devonian formation of the interior continental area of North America.

Am. Naturalist, vol. 23, pp. 229-243. 1889.

Description of the characteristics, distribution, and relations, and discussion of equivalency, stratigraphic range, and paleontologic relations of the several members.

- A description of the Rockford shales of Iowa.

Davenport, Acad. Sci., Proc., vol. 5, part 1, pp. 100-109. 1889.

Description of stratigraphy, and lists of fossils.

WEED, Walter Harvey. On the formation of siliceous sinter by the vegetation of thermal springs.

Am. Jour. Sci., 3d series, vol. 37, pp. 351-359. 1889.

Describes the formation of siliceous deposits by algae and mosses in the geyser waters in the Yellowstone Park; discusses their rate of growth; gives analyses of Yellowstone Park and New Zealand sinters, and discusses the nature of the latter. Preceded by a general discussion of the deposition of silica by geyser waters.

WENDT, Arthur F. The copper ores of the southwest.

Am. Inst. Mining Engineers, Trans., vol. 15, pp. 25-77, plate. 1887.

Abstract, *Eng. and Mining Jour.*, vol. 43, pp. 94-96, 112-114, 133-134, 150-152, 183-185. 1887.

Describes the occurrence of ores in Carboniferous limestones, and associated eruptives at Santa Rita, New Mexico, Clifton, Bisbee, and Black Range districts, Arizona, and in recent formations at Molaje, Lower California. Includes notes on micropetrography, by A. A. Julien.

West Virginia, coal, ASHBURNER.

coal from Jefferson County; analysis, WHITFIELD, J. E.

WHITE, Charles A. Report Division of Mesozoic Invertebrates.

U. S. Geol. Survey, 6th Annual Report, J. W. Powell, 1884-'85, pp. 72-74. 1885.

Announces his conclusions in regard to the position of the Chico and Teton groups, and the auriferous slate series of California. Calls attention to the occurrence of a Cretaceous formation in Mendocino County, California, to which the provisional name of Wallala group is given.

WHITE, Charles A.—Continued.

- On the age of the coal found in the region traversed by the Rio Grande.

Am. Jour. Sci., 3d series, vol. 33, pp. 18-20. 1887.

Refers it either to the Laramie or Fox Hills formation, or to both, and describes the extension of these formations southward into Mexico.

- On the inter-relation of contemporaneous fossil faunas and floras.

Am. Jour. Sci., 3d series, vol. 33, pp. 364-374. 1887.

Discusses the faunal and floral relations and contemporaneity of deposition of the Laramie, and the equivalents of the Bridger, and the stratigraphic position of these groups.

- On the relation of the Laramie moluscan fauna to that of the succeeding fresh-water Eocene and other groups.

U. S. Geol. Survey, Bull., vol. 5, pp. 391-442, 5 plates. No. 34. 1887.

Abstracts, *Science*, vol. 10, pp. 126-127. 1888; *Popular Science Monthly*, vol. 33, p. 420, 1 col. 1888.

Describes Wasatch fossils from San Pete Valley and adjacent portions of Wasatch Mountains, and discusses the faunal and stratigraphic relations of these beds, and of the Bear River Laramie, Wasatch, Laramie, Puerco, and Fort Union groups. (The abstract in *Science* is a very complete one.)

- On the Cretaceous formations of Texas, and their relation to those of other portions of North America.

Philadelphia, Acad. Sci., Proc., 1887, part 1, pp. 39-47.

Describes results of studies by R. T. Hill, from which is given a descriptive table of the strata of the eastern half of Texas, and their supposed equivalents in the Mississippi, and upper Missouri River sections. Discusses the equivalency, distribution, subdivisions, and relations to associated formations.

- On the occurrence of later Cretaceous deposits in Iowa.

Am. Geologist, vol. 1, pp. 221-227. 1888.

References to localities and occurrence of fossils, and discussion of their stratigraphic position in the Cretaceous, the position of Cretaceous shore line, and original thickness and extent of the Cretaceous in Iowa.

- On the relation of the Laramie group to earlier and later formations.

Am. Jour. Sci., 3d series, vol. 35, pp. 432-438. 1888.

Abstract, *Nature*, vol. 38, p. 189, 7 lines. 1888.

Description of the relations of the Laramie in the lower Rio Grande region in Texas and

WHITE, Charles A.—Continued.

Mexico, references to the relations of the Belly River series, and discussion of the history of the late Cretaceous and early Tertiary in western America, and the Cretaceous age of the greater part of the Laramie.

— On the Puget group of Washington Territory.

Am. Jour. Sci., 3d series, vol. 36, pp. 443-450. 1888.

Abstract, Nature, vol. 39, p. 189, 16 lines. 1888.

Statement of general relations and discussion of genesis, history, biologic relations, and correlation with Laramie and Chicco-Téjon groups.

— Mountain upthrusts.

Am. Naturalist, vol. 22, pp. 399-408. 1888.

Sections and descriptions of the Uinta fold, and the Junction and Yampa mountain upthrusts, and discussion of their history and the philosophy of their uplift.

— [On the fauna of the Permian of Baylor, Archer and Wichita counties, Texas.]

Am. Naturalist, vol. 22, p. 926, $\frac{1}{2}$ p. 1888.

Statement of his opinion in regard to the Permian age of the formations.

— On *Hindeastræa*, a new generic form of Cretaceous *Astræda*.

Geol. Magazine, 3d decade, vol. 5, pp. 362-364. 1888.

Incidentally refers to stratigraphic position of Ripley group.

— Remarks on the genus *Aucella*, with special reference to its occurrence in California.

U. S. Geol. Survey, Monograph, No. 13, Quicksilver deposits of the Pacific slope. By G. F. Becker, pp. 226-232, plates III, IV. 1888.

Includes a statement in regard to the age of the containing series indicated by its occurrence.

— Report—Mesozoic division of invertebrate paleontology.

U. S. Geol. Survey, Seventh Report, J. W. Powell, 1885-'86, pp. 117-120. 1888.

References to thickness, age, and fauna of coal-bearing series in hills south of San Pete valley, Utah, their faunal relation to the Laramie and their equivalency with the coal-bearing beds near Evanston, Wyoming; the occurrence of coal in the Laramie in Cottonwood Cañon, the equivalency of the coal series in Pleasant valley and Coalville, Utah, and the marine origin of the containing strata; the faunal relations of the Laramie and Wasatch, and extent of land area during the latter part of the Jurassic period.

WHITE, Charles A.—Continued.

— The lower Cretaceous of the Southwest and its relation to the underlying and overlying formations.

Am. Jour. Sci., 3d series, vol. 38, pp. 440-445. 1889.

An account of its characteristics and relations in various districts in Texas and northern Mexico, and discussion of its stratigraphic range, equivalency, history, and extent.

— On the Permian formation of Texas.

Am. Naturalist, vol. 23, pp. 109-128, pl. (February, 1889).

Discussion of faunal and stratigraphic relations and range; brief description of its several members, estimates of thickness, dip, and extent, characteristics and relations of associated formations, and review of evidence and opinions bearing on the identity and equivalency of the Permian in North America.

— On invertebrate fossils from the Pacific coast.

U. S. Geol. Survey, Bull., vol. 8, pp. 433-532, pls. I-XIV. No. 51. 1889.

Abstract. Am. Geologist, vol. 5, pp. 109-110, $\frac{1}{2}$ p. 1890.

The paper consists of five parts: I. New fossil mollusca from the Chicco-Téjon series of California, which includes a discussion of the stratigraphic and faunal relation of the series. II. Equivalents of the Chicco-Téjon series in Oregon and Washington; a description of a number of new or little-known localities. III. Cretaceous fossils from Vancouver Island region, including some remarks on the faunal relations of the Vancouver group. IV. Molluscan fauna of the Puget group; includes some general remarks on the geology of the group, its history, extent, and faunal and floral relations. V. Mesozoic mollusca from the southern coast of the Alaskan peninsula, including some remarks on the horizon of the containing beds.

— The North American Mesozoic.

Science, vol. 14, pp. 160-166. 1889.

Nature, vol. 40, p. 557, 12 lines. 1889.

Abstracts of address to Am. Assoc. Adv. Science, 1889.

WHITE, C. D. Carboniferous glaciation in the southern and eastern hemispheres, with some notes on the *Glossopteris* flora.

Am. Geologist, vol. 3, pp. 299-330. 1889.

Sets forth a summary of the evidence of an early Carboniferous glacial epoch in the region bordering the Indian Ocean in Asia, Africa, and Australia, and reviews the discussions of its date and extent, the correlation of the terranes by which it is represented in different regions, the origin and history of the *Glossopteris* flora, and the evidence of an Africa-India-Australian continent.

WHITE, I. C. Rounded boulders at high altitudes along some Appalachian rivers.

Am. Jour. Sci., 3d series, vol. 34, pp. 374-381. 1887.

A discussion of the history recorded in the boulder deposits and terraces, especially in connection with the existence of a glacial ice dam in the Ohio. Discusses the relations and significance of boulder deposits along the upper Ohio, the Kanawha, the Pittsburgh regions, the Potomac, and the James; the boulder and clay-covered divides of the Teazes valley near Charleston and Pittsburgh and McKeesport, Pennsylvania; the terraces of the Monongahela and Youghiogheny, the variations in altitude of these boulder and terrace deposits, and the origin of the high-level deposits along the Cheat River of West Virginia.

WHITEAVES, J. F. Notes on some Mesozoic fossils from various localities on the coast of British Columbia, for the most part collected by Dr. G. M. Dawson in the summer of 1886.

Canada, Geol. and Nat. Hist. Survey, Report, 1886, part B, pp. 108-114. Appendix I. 1887.

Includes mention of localities and some suggestions in regard to horizons indicated by the fossils.

WHITFIELD, J. Edward. [Analyses of volcanic dusts.]

U. S. Geol. Survey, Bull., vol. 7, p. 141, $\frac{1}{2}$ p. No. 42. 1887.

From Marsh Creek valley, Idaho, Little Sage Creek, Montana, and Devil's pathway, Montana.

— Coal from Jefferson County, West Virginia.

U. S. Geol. Survey, Bull., vol. 7, p. 146, $\frac{1}{2}$ p. No. 42. 1887.

Analysis.

— Coal from Walnut Cove, Stokes County, North Carolina.

U. S. Geol. Survey, Bull., vol. 7, p. 146, $\frac{1}{2}$ p. No. 42. 1887.

Analysis.

WHITFIELD, R. P. New Jersey Cretaceous.

Am. Naturalist, vol. 21, pp. 66-69. 1887.

General review of stratigraphy and faunal relations of the Cretaceous and Eocene, and discussion of the equivalency of the former with members in the upper Missouri section.

— [On the use of the term "Quaternary."]

International Congress of Geologists, Am. Committee Reports, 1888, F, pp. 15-16, $\frac{1}{2}$ p.

WHITFIELD, R. P.—Continued.

Am. Geologist, vol. 2, pp. 281-282. 1888.

Consideration of its taxonomic value.

— Observations on some imperfectly known fossils from the Calcareous sandrock of Lake Champlain, and descriptions of several new forms.

Am. Museum Nat. Hist., Bull., vol. 2, pp. 41-63, plates VII-X. 1889.

Preceded by a brief description of the relations near Plattsburg, New York.

— Note on the faunal resemblance between the Cretaceous formations of New Jersey and those of the Gulf States.

Am. Museum Nat. Hist., Bull., vol. 2, pp. 113-116. 1889.

Parallel lists of species from Alabama, Mississippi, Texas, and Dakota, and comments on the faunal relations.

WHITING, H. A. Mono County.

California, Eighth Report of State Mineralogists, pp. 352-401. 1888.

Includes incidental references to geologic relations at various localities and to petrographic features of some of the rocks.

WHITTLE, Charles Livy. The intrusive and extrusive Triassic trap sheets of the Connecticut valley. See **DAVIS, William Morris**, and.

WILLIAMS, George H. On a plan proposed for future work upon the geological map of the Baltimore region.

Johns Hopkins Univ. Circular, No. 59, pp. 122-123. 1887.

Statement of scope.

— Rutil nach Ilmenit in verändertem Diabas. Pleonast (Hercyint) in Norit von Hudson-Fluss. Perowskit in Serpentin (Peridotit) von Syracuse, New York.

Neues Jahrbuch, 1887, Band 2, ss. 263-267.

Describes micropetrography of diabase from Big Quinnesec Falls, Menominee River; the norite of the Cortlandt series, and the serpentine of Syracuse, the origin of which is also briefly discussed.

— The norites of the "Cortlandt series," on the Hudson River near Peekskill, New York.

Am. Jour. Sci., 3d series, vol. 33, pp. 135-144, 191-199. 1887.

Abstract, *Neues Jahrbuch*, 1887, Band 2, ss. 316-317.

After a review of the distribution of hypersthene rocks in general, describes and discusses the micropetrography, occurrence

WILLIAMS, George H.—Continued.
and some structural relations of the "norite proper," "hornblende norite," "mica norite," "hyperite," or "augite norite," "pyroxenite" and their gradations.

— Holocrystalline granitic structure in eruptive rocks of Tertiary age.

Am. Jour. Sci., 3d series, vol. 33, pp. 315-316, 1887.

Notice of some of Stelzner conclusions in his memoir on "The Geology of the Argentine Republic." Incidentally refers to the nature of the "Nevadite" of von Richthofen and discusses the relations of structure in rock masses to the conditions under which they solidify.

— On the serpentine (peridotite) occurring in the Onondaga salt group at Syracuse, New York.

Am. Jour. Sci., 3d series, vol. 34, pp. 137-145, 1887.

Abstracts by author. *Science*, vol. 9, pp. 137-145, 1887; *Neues Jahrbuch*, 1888, Band 1, ss. 80-81.

Describes the occurrence of the rock and its chemio and mineralogic constituents. Discusses its alteration from peridotite and its close resemblance to the dikes of Elliott County, Kentucky.

— The gabbros and associated hornblende rocks occurring in the neighborhood of Baltimore, Maryland. *U. S. Geological Survey, Bull. No. 28.*

Abstract, *Geol. Mag.*, 3d decade, vol. 4, pp. 87-88, 1887.

— Some examples of the dynamic metamorphism of the ancient eruptive rocks on the south shore of Lake Superior. [Abstract.]

Am. Assoc. Adv. Science, Proc., vol. 36, pp. 225-226, 1888.

Description of certain modifications which rocks undergo when subjected to the action of mountain-making forces.

— The gabbros and diorites of the "Cortlandt series" on the Hudson River near Peekskill, New York.

Am. Jour. Sci., 3d series, vol. 35, pp. 438-448, 1888.

Abstract, *Am. Naturalist*, vol. 22, p. 929, $\frac{1}{2}$ p. 1888.

References to occurrence and relation to each other, and petrographic description.

— The contact metamorphism produced in the adjoining mica schists and limestones by the massive rocks of the "Cortlandt series" near Peekskill, New York.

WILLIAMS, George H.—Continued.

Am. Jour. Sci., 3d series, vol. 36, pp. 254-269, pl. vi. 1888.

Abstracts, *Johns Hopkins Univ. Circulars*, vol. 7, pp. 63-65, No. 65, 1888; *Am. Naturalist*, vol. 23, pp. 1020-1021, $\frac{1}{2}$ p., 1888.

Mainly petrographic. Describes contact relations at Cruger's Station and on the southern end of Verplanck's Point. Résumé of evidence of the eruptive nature of the massive members of the Cortlandt series and references to conditions of solidification, and location of the center of eruptive action.

— [Subdivision of Archean, nature of oldest crystalline schists, origin of serpentine, and use of term "Taconic."]

International Congress of Geologists, Am. Committee Reports, 1888, A, pp. 67-68.

— On the use of the term "Taconic."

International Congress of Geologists, Am. Committee Reports, 1888, B, p. 17, 3 lines.

Am. Geologist, vol. 2, p. 207. 1888.

Expression of opinion.

— Geology of the Baltimore region.

Johns Hopkins Univ. Circulars, vol. 7, p. 73, $\frac{1}{2}$ col. No. 65. 1888.

Refers to the sequence of the eruptives.

— Progress of the work on the Archean geology of Maryland.

Johns Hopkins Univ. Circulars, vol. 7, pp. 61-63. No. 65. 1888.

General sketch of Maryland geology and description of the relations of the gneisses and various eruptives in the Baltimore region and northward to the Pennsylvania line.

— Geology of Fernando de Noronha, Part II, petrography.

Am. Jour. Sci., 3d series, vol. 37, pp. 178-189, 1889.

Abstract, *Am. Naturalist*, vol. 23, p. 522, $\frac{1}{2}$ p. 1889.

Petrographic description of specimens of phonolites, trachytes, and andesites.

— Contributions to the mineralogy of Maryland.

Johns Hopkins Univ. Circulars, vol. 8, pp. 99-100. No. 75. 1889.

Includes reference to the occurrence and composition of an ottrelite rock in Frederick County.

WILLIAMS, H. S. Methods of instruction in general geology.

Am. Naturalist, vol. 21, pp. 616-626. 1887.

— On the fossil faunas of the upper Devonian. The Genesee section, New York.

U. S. Geol. Survey, Bull., vol. 6, pp. 481-603, pls. 1-IV. No. 41. 1887.

WILLIAMS, H. S.—Continued.

Discussion of the paleontologic and stratigraphic relations, equivalency, and range of the members of the upper Devonian and base of the lower Carboniferous in southern New York, northern Pennsylvania, and Ohio. Detailed description of stratigraphy and fauna at various localities from Genesee County, New York, to McKean County, Pennsylvania.

— On the different types of the Devonian system in North America.

Am. Jour. Sci., 3d series, vol. 35, pp. 51-59. 1888.

Abstracts, Nature, vol. 37, p. 358, 11 lines, 1888; *Am. Assoc. Adv. Science, Proc.*, vol. 36, pp. 207-208, $\frac{1}{2}$ p. 1888.

Résumé of the more prominent features and discussion of the paleontologic and stratigraphic relations of the Devonian formations in the several areas.

— Report of the subcommittee on the upper Paleozoic (Devonic).

International Congress of Geologists, Am. Committee Reports, 1888, C, pp. 31.

Am. Geologist, vol. 2, pp. 225-239. 1888.

Review by Jules Marcou, *Am. Geologist*, vol. 3, pp. 60-61, $\frac{1}{2}$ p. 1889.

A general review of the distribution, taxonomy, and nomenclature of the Devonian members of North America.

— On the relation of the Devonian faunæ of Iowa.

Am. Geologist, vol. 3, pp. 230-233. 1889.

Discussion of the faunal relations, and stratigraphy and equivalency of the Iowa Devonian.

— The use of fossils in determining the age of geologic terranes. [Abstract.]

Am. Assoc. Adv. Science, Proc., vol. 37, p. 206, $\frac{1}{2}$ p. 1889.

Discusses the value and limitation of paleontologic correlations.

— [Comparison of cis- with trans-Atlantic formations.]

Nature, vol. 40, p. 557, $\frac{1}{2}$ col. 1888.

Abstract of paper read to American Association, 1889.

Faunal relations of Devonian of England and America.

WILLIAMS, S. G. Note on the lower Helderberg rocks of Cayuga Lake.

New York, Sixth Report of the State Geologist, 1886, pp. 10-12. 1887.

Notice of additional discoveries of fossils. Repeats his opinion that the "Salina and lower Helderberg are merely different phases of one geological period, deposited under very different conditions indeed, but to a great extent contemporaneously."

WILLIAMS, S. G.—Continued.

— The Tully limestone, its distribution, and its known fossils.

New York, Sixth Report of the Geologist, 1886, pp. 13-29. Map. 1887.

Describes its line of outcrop, constituents, thickness, structure, and fossils. Accompanied by a map of its outcrop.

WILLIS, Bailey. Changes in river courses in Washington Territory due to glaciation.

U. S. Geol. Survey, Bull., vol. 6, pp. 473-480, 4 plates. No. 40. 1887.

Discussion of the agency of lava flows and glaciers in diverting a portion of the course of the Columbia River, Accompanied by a geologic map indicating the formations along a line of reconnaissance, and hachured maps showing preglacial channel of the Similkameen River, the lower valley of the Okinakame River, and Columbia River from the latter to Lake Chelan.

— Topography and structure in the Bays Mountains, Tennessee.

School of Mines Quarterly, vol. 8, pp. 242-252. 1887.

Describes their structure, topography, and drainage, and discusses the relations of drainage and topography to structure, and the time and extent of Appalachian uplift.

[—] [Absence of Sierra Nevada structure in northern Washington Territory.]

Washington, Phil. Soc., Bull., vol. 9, p. 8, $\frac{1}{2}$ p. 1887.

States that the eastern face of the Cascade Range is not determined by a great fault.

— The marble of Hawkins County, Tennessee.

School of Mines Quarterly, vol. 8, pp. 112-123. 1888.

Description of a bed of Trenton marble, and the great fault by which it is cut off from the adjoining Cambrian rocks.

— Mount Rainier and its glaciers.

Washington, Phil. Soc., Bull., vol. 10, p. 10, $\frac{1}{2}$ p. 1888.

Brief mention of the paper, and statement in regard to the relations of Mounts Rainier and Shasta as points of volcanic activity.

— Round about Asheville.

National Geogr. Mag., vol. 1, pp. 291-300. Map. 1889.

Classification of the topographic characteristics of the western North Carolina-East Tennessee region, and discussion of evidence and history of successive stages of elevation and base leveling.

WINCHELL, Alexander. Report of geological observations made in north-

WINCHELL, Alexander.—Continued.
eastern Minnesota during the season of 1886.

Geol. and Nat. Hist. Survey of Minn., 15th Report, 1886, pp. 7-206. Map. 1887.

Field notes of work in region north of the western part of Lake Superior. Describes and figures many details of structure, rock texture, and distribution, volcanism, vein stones, etc., in the crystalline and metamorphic series. In a summary of observations (p. 172) gives a general description of the region, and discusses the structural and stratigraphic relations, extent, equivalency, modifications, variations, origin, and geologic history of the formations. Reviews Lawson on the Keewatin series, and on gneissic foliation. Notices some glacial phenomena in the region. Accompanied by a folded colored geologic map, in part, by N. H. Winchell.

— Unconformability between the Animikie and the Vermilion series.

Am. Jour. Sci., 3d series, vol. 34, p. 314. 1887.

"The Animikie flint schists dipping, 5° S. have been traced by me to within seven feet of sericitic argillites of the Vermilion series dipping about 67° NE."

— The unconformities of the Animikie in Minnesota.

Am. Geologist, vol. 1, pp. 14-24. 1888.

Reference to characteristics, relations, distribution, and equivalency of the Animikie, and description and discussion of relations in northern Minnesota and some adjacent portions of Canada.

— Some effects of pressure of a continental glacier.

Am. Geologist, vol. 1, pp. 139-143. 1888.

Discussion of relations of crustal deformation to the great lava outflows of the far West, and to post-glacial uplift of shore lines in the Atlantic coast region.

— The Taconic question.

Am. Geologist, vol. 1, pp. 347-363. 1888.

Review of literature, and discussion of the grounds of the opponents of the Taconic system, and the nomenclature of the lower Paleozoic.

— Geology as a means of culture.

Am. Geologist, vol. 2, pp. 44-51, 100-114. 1888.

— [On the use of the term "Taconic."]

International Congress of Geologists, Am. Committee Reports, 1888, B, pp. 12-13.

Am. Geologist, vol. 2, pp. 202-203. 1888.
Discussion of its applicability.

— [On the nomenclature of the Tertiary, and the faunal relations, and designation of the Quaternary.]

WINCHELL, Alexander.—Continued.

International Congress of Geologists, Am. Committee Reports, 1888, F, pp. 16-17, § p.

Am. Geologist, vol. 2, pp. 282-283. 1888.

Discusses the taxonomic value of the Lyellian divisions, and the term "Quaternary."

— Report of a geological survey in Minnesota during the season of 1887, embracing comparative observations in some other regions.

Minnesota, Geol. and Nat. Hist. Survey, 15th Report, pp. 133-391. 1888.

Description and discussion of relations in northeastern Minnesota, preceded by an account and discussion of observations in the original Huronian in Canada, and in Northern Michigan, and Wisconsin.

— Systematic results of a field study of the Archean rocks of the northwest. [Abstract.]

Am. Assoc. Adv. Science, vol. 37, pp. 205-206, § p. 1889.

Abstract, Science, vol. 12, p. 100, 12 lines. 1888.

Summary statement of stratigraphic succession and equivalency of the crystalline series of the Northwest.

— Conglomerates enclosed in gneissic terranes.

Am. Geologist, vol. 3, pp. 153-165. 1889.

Describes pebble-bearing gneisses in the region northwest of Lake Superior, discusses the bearing of their occurrence on the origin and history of the gneiss, and cites other instances of conglomeritic crystalline rocks in New England and in Europe.

[—] Rejoinder to Dr. Lawson [on rock foliation and sedimentation].

Am. Geologist, vol. 3, pp. 193-195. 1889.

Discussion of some conditions of metamorphism, and citation of English investigations bearing on the question.

— Two systems confounded in the Huronian.

Am. Geologist, vol. 3, pp. 212-214. 1889.

Review of Bonney. "Notes on a part of the Huronian series in the vicinity of Sudbury, Canada." Discusses the age and equivalency of the beds described by Bonney, and the correlation of the post-Laurentian series in the Sudbury region with the Huronian and associated series in the Lake Superior district.

— Conglomerates enclosed in gneissic terranes.

Am. Geologist, vol. 3, pp. 256-261. 1889.

Discusses the bearing of the occurrence of pebbles in crystalline rocks of various ages, including the Laurentian, on the clastic origin of some of the Laurentian members.

WINCHELL, Alexander—Continued.

- On the Archean. See **FRAZER**, Report on Archean.

WINCHELL, H. V. Partial report of observations made by.

Minnesota, Geol. and Nat. Hist. Survey, Fifteenth Report, 1886, pp. 403-419. 1887.

On crystalline rocks of a portion of northeastern Minnesota.

- Report of observations made during the summer of 1887.

Minnesota, Geol. and Nat. Hist. Survey, Sixteenth Report, pp. 395-478, map. 1888.

Description of relations and characteristics of crystalline rocks along various routes in northwest Minnesota. References to Cretaceous outliers.

- The diabasic schists containing the jaspilyte beds of northeastern Minnesota.

Am. Geologist, vol. 3, pp. 18-22. 1889.

Description and discussion of relations of the massive and of schistose basic series and their siliceous and ferruginous associates.

- Report of field observations made during the season of 1888 in the iron regions of Minnesota.

Minnesota, Geol. and Nat. Hist. Survey, Seventeenth Report, pp. 77-145. 1889.

Notes on region east of Tower. Discussion of the relations of the several formations, pages 128-135.

- [Professor Irving and the Keewatin series, and the origin and horizon of the iron ores of the Vermilion Lake series.] See **WINCHELL, N. H.** and **H. V.**

- On a possible chemical origin of the iron ores of the Keewatin in Minnesota. See **WINCHELL, N. H.**, and **H. V.**

WINCHELL, N. H. Geological report.

Minnesota, Geol. and Nat. Hist. Survey, Fifteenth Report, 1886, pp. 211-399, map. 1887.

Detailed description of Vermilion Lake iron region and vicinity, and discussion of the structural relations, stratigraphy, equivalency, age, extent, origin, etc., of the several formations and of the "jaspilyte rock." Gives list of some glacial strata. Describes some features of the Mayhew Lake titaniferous iron-ore district. Accompanied by a folded, colored, geologic map.

- Notes on the classification and nomenclature for the American Committee of the International Geological Congress, March, 1887.

WINCHELL, N. H.—Continued.

American Naturalist, vol. 21, pp. 693-700. 1887.

After stating the present condition of the Taconic question, discusses the history, application, and equivalency of the terms "Taconic," "Primordial," and "Cambrian," showing that "Taconic" was prior to "Cambrian" under the same conditions of application, and was originally applied with equal error. It is urged that "Taconic" should be retained for the first fauna and "Cambrian" for the second, in accordance with the purpose of their authors. Discusses the subdivisions of the Archean and the use of the term.

- The granite and quartzite contact of the Aurora mine, Gogebic iron range, at Ironwood, Michigan. [Abstract.]

Am. Assoc. Adv. Science, Proc., vol. 36, p. 211, $\frac{1}{2}$ p. 1888.

Discusses the nature and origin of the granite, and refers it to the Huronian.

- The Animikie black slates and quartzites, and the Ogishke conglomerate of Minnesota, the equivalent of the "original Huronian."

Am. Geologist, vol. 1, pp. 11-14. 1888.

Includes a review of the characteristics of the original Huronian, and a table suggesting the equivalency of the several members with similar rocks in Minnesota and Wisconsin.

- Some objections to the term Taconic considered.

Am. Geologist, vol. 1, pp. 162-173. 1888.

Discussion of the status of the term and discussion of the objections advanced against its adoption.

- A great primordial quartzite.

Am. Geologist, vol. 1, pp. 173-178. 1888.

Correlation of Cambrian quartzites of the Taconic region, the Potsdam sandstone of New York, the Huronian quartzites of Minnesota and Wisconsin, the "Potsdam" sandstone of the Black Hills of Dakota, and the eastern sandstones of Michigan.

- [—] Note [on small outliers of Cretaceous in Minnesota].

Am. Geologist, vol. 2, p. 334, $\frac{1}{2}$ p. 1888.

References to localities and characteristics.

- Report of the subcommittee on the lower Paleozoic.

International Congress of Geologists, Am. Committee Reports, 1888, B, pp. 37.

Am. Geologist, vol. 2, pp. 193-224. 1888.

Discussion of nomenclature, especially in regard to the use of the terms "Taconic" and "St. Croix." Includes extracts of letters from J. D. Dana, S. W. Ford, James Hall, C. H. Hitchcock, Alexander Winchell, J. S. Newberry, G. H. Williams, J. W. Dawson, A. R. C.

WINCHELL, N. H.—Continued.

Selwyn, B. K. Emerson, Joseph Le Conte, James Macfarlane, S. F. Emmons, A. Hague, W. P. Blake, and C. E. Dutton, and synopsis of conclusions by C. D. Walcott on the "Taconic system of Emmons," which is also reviewed.

— **Preface.**

Minnesota, *Geology of, Final Report*, vol. 2, pp. 13-24. 1888.

Discussion of some of the stratigraphic relations and equivalency of members of the Cambrian in the Minnesota and Mississippi valleys. Reference to Cretaceous areas and glacial history.

— **The geology of Wabasha County.**

Minnesota, *Geology of, Final Report*, vol. 2, pp. 1-19, map. 1888.

Description of Cambrian and Trenton areas and the drifts and terraces. Reference to the probable occurrence of Cretaceous. Discussion of the history of some drainage and topographic features. Accompanied by a colored geologic map.

— **The geology of Goodhue County.**

Minnesota, *Geology of, Final Report*, vol. 2, pp. 20-61, map. 1888.

Description of Cambrian, Trenton, Cretaceous, drifts and terraces. List of fossils. Discussion of relation of some drainage features, ancient and modern, extent of Cretaceous, origin of some topographic features, and history of some of the drifts. Accompanied by a colored geologic map.

— **The geology of Dakota County.**

Minnesota, *Geology of, Final Report*, vol. 2, pp. 62-101, map. 1888.

Description of lower Silurian and Cambrian areas, drifts, faults, terraces, gravel plains, remains of ancient drainage systems, Cretaceous outcrops, and the glacial history of the region. Accompanied by a colored geologic map.

— **The geology of Hennepin County.**

Minnesota, *Geology of, Final Report*, vol. 2, pp. 264-344, map, pls. A¹, M-Z. 1888.

Descriptions of Trenton limestone, St. Peter sandstone, and Cretaceous outcrops, and the drifts and terraces. Records of artesian wells. Review of descriptions of St. Anthony's Falls, and discussion of their history and rate of recession. Accompanied by a colored geologic map.

— **The geology of Ramsey County.**

Minnesota, *Geology of, Final Report*, vol. 2, pp. 345-374, map. 1888.

Description of Trenton and St. Peter sandstone and the drifts. Discussion of origin of certain topographic features, the extent and stratigraphic relations of some of the members of the rock formations, and the equivalency of some of the beds met with in the artesian

WINCHELL, N. H.—Continued.

wells. Accompanied by a colored geologic map.

— **The geology of Washington County.**

Minnesota, *Geology of, Final Report*, vol. 2, pp. 375-398, map. 1888.

Description of Trenton limestone, St. Peter sandstone, and lower magnesian limestone areas, the drifts, terraces, an anticlinal and faults in the Cambrian, and an unconformity between the lower magnesian and the St. Peter sandstone. Accompanied by a colored geologic map.

— **Report [original Huronian, iron-bearing rocks in Marquette and Gogebic region, and northeastern Minnesota].**

Minnesota, *Geol. and Nat. Hist. Survey, Sixteenth Report*, pp. 13-129. 1888.

Description of various localities, and discussion of structural relations, stratigraphy, genesis, and equivalency of the several pre-Cambrian members. List of directions of glacial striae.

— **Natural gas in Minnesota.**

Minnesota, *Geol. and Nat. Hist. Survey, Bull. No. 5*, pp. 39. St. Paul, 1889.

Includes records of deep borings near Freeborn, Albert Lea, Mankato, Stillwater, Moorhead, and Duluth, and some comments on the geologic horizon and relations of the beds pierced.

— **The crystalline rocks of Minnesota.**

General report of progress made in the study of their field relations. Statement of problems yet to be solved.

Minnesota, *Geol. and Nat. Hist. Survey, Seventeenth Report*, pp. 5-74. 1889.

Review by J. D. Dana, *Am. Jour. Sci.*, 3d series, vol. 39, pp. 67-68, $\frac{1}{2}$ p. 1890.

Abstract, *Am. Geologist*, vol. 5, pp. 59-60. 1890.

A general review and discussion of the stratigraphy, history, and relations of formations from the Laurentian to the St. Croix sandstone.

[—] **List of American publications between 1872 and 1889 that have some relation to the crystalline rocks of the Northwest.**

Minnesota, *Geol. and Nat. Hist. Survey, Seventeenth Report*, pp. 233-265. 1889.

— **Notice of the discovery of Lingula and Paradoxides in the red quartzite of Minnesota.**

Minnesota, *Acad. Sci., Bull.*, vol. 3, part 1, pp. 103-105. 1889.

Description of the remains, and brief reference to the relations and age of the formation, and its representatives elsewhere.

WINCHELL, N. H.—Continued.

- Some thoughts on eruptive rocks, with special reference to those of Minnesota.

Am. Assoc. Adv. Sci., Proc., vol. 37, pp. 212-221. 1889.

Reviews classification and relations of eruptive rocks in general, advances hypothesis as to the genesis of acid and of basic eruptives, and gives a résumé of the stratigraphic relations and eruptive contents of the several crystalline rock series of the Northwest.

- Methods of stratigraphy in studying the Huronian.

Am. Geologist, vol. 4, pp. 342-357. 1889.

Reviews the Huronian system, and discusses its taxonomy, relations to Laurentian, correlation outside of the type area, stratigraphic range and characteristics, and past and present methods of research in this connection.

- On the Archean. See **FRAZER**. Report on Archean.

- and **WINCHELL, H. V.** [Professor Irving and the Keewatin series, and the origin and horizon of the iron ores of the Vermilion Lake series.]

Am. Geologist, vol. 4, pp. 383-386. 1889.

Review of Irving's writings in this connection, including references to the distribution, equivalency, and sideritic contents of iron-bearing series of Minnesota.

- — On a possible chemical origin of the iron ores of the Keewatin in Minnesota.

Am. Geologist, vol. 4, pp. 291-300. 1889.

Point out the differences in characteristics and relations of the Keewatin and Huronian ores. Discuss the history of the Keewatin formation and advance a hypothesis as to the genesis of its siliceous and ferruginous members.

WINSLOW, Arthur. The Lehigh River cross-section, measured, mapped, and described in detail. Edited by J. P. Lesley.

Pennsylvania, Report of Geol. Survey, 1886, part 4, pp. 1331-1371, sheets 1-5, in atlas. 1887.

Detailed descriptions of stratigraphy and structure. Discussion of the stratigraphic range of some of the members of Nos. IX and X. Accompanied by maps and cross and columnar sections.

- A preliminary report on a portion of the coal regions of Arkansas.

Arkansas, Geol. Survey, Report for 1888 vol. 3, pp. 1-92, map. 1888.

WINSLOW, Arthur—Continued.

General account of distribution, stratigraphy, and structure. Description of prominent localities. Analyses. Economic. Geologic map.

Wisconsin, Animikie slates and quartzites, WINCHELL, N. H.

Archean rocks of the Northwest, WINCHELL, A.

boulder trains of central Wisconsin, CHAMBERLIN, T. C.

classification of Cambrian and pre-Cambrian, IRVING.

driftless area, CHAMBERLIN, T. C. CHAMBERLIN and SALISBURY.

granites of the Northwest, HALL, C. W.

Huronian, IRVING.

Gogebic iron region, ENG. AND MINING JOUR. IRVING.

great primordial quartzite, WINCHELL, N. H.

Great Lake basins of St. Lawrence, DRUMMOND.

iron ores of Penoque-Gogebic, VAN HISE.

Irving and Chamberlin on Lake Superior sandstones, AM. GEOLOGIST.

loess and clays, analyses, RIGGS.

Penoque Gap region, WINCHELL, A. Quaternary of northwestern Wisconsin, CHAMBERLIN.

raised beaches of Lake Michigan, LEVERETT.

Report—Lake Superior division, U. S. Geol. Survey, IRVING.

- Report—Glacial division, U. S. Geol. Survey, CHAMBERLIN.

rock from Penoque iron ranges, analysis, RIGGS.

Taconic system, MILLER.

Wisconsin Academy of Sciences, Arts, and Letters, Transactions, vol. 7.

Raised beaches of Lake Michigan, LEVERETT.

WOODWARD, Henry. On the discovery of *Turrilepas* in the Utica formation (Ordovician) of Ottawa, Canada.

Geol. Magazine, decade III, vol. 6, pp. 271-275. 1889.

Includes stratigraphic section of the beds at Rifle Range, near Ottawa, by H. M. Aml.

WOODWARD, R. S. On the form and position of the sea level with special reference to its dependence on superficial masses symmetrically disposed about a normal of the earth's surface.

U. S. Geol. Survey, Bull., vol. 8, pp. 87-172, No. 48. 1888.

Incidentally considers certain geologic causes of earth-crust deformation.

WOOLBRIDGE, C. W. The river-lake system of western Michigan.

Am. Geologist, vol. 1, pp. 143-146. 1888.

Description of relations and discussion of origin and history.

— The post-glacial geology of Ann Arbor, Michigan.

Am. Geologist, vol. 2, pp. 35-39. 1888.

Description of delta deposits and shore lines, and discussion of their history.

WOOLMAN, Lewis. Geological result of the boring of an artesian well at Atlantic City, New Jersey.

Philadelphia, Acad. Sci., Proc., 1887, pp. 339-342.

Description of 1,121-foot record, lists of fossils and statement in regard to horizons of the Tertiary beds passed through.

— [Fossiliferous Cretaceous limestone from near Clementon, New Jersey.]

Am. Naturalist, vol. 23, p. 544, 3 lines. 1889.

Notice of occurrence and fossils.

WOOSTER, L. C. The coal measures of Kansas.

Science, vol. 12, p. 119, $\frac{1}{2}$ col. 1888.

Eng. and Mining Jour., vol. 46, p. 240, $\frac{1}{2}$ col. 4^o. 1888.

Describes 2,000-foot bore-hole entirely in coal measures and discusses the conditions under which the coal measures were deposited.

— The limit of drift [Kansas].

Science, vol. 12, p. 132, $\frac{1}{2}$ p. 1888.

Calls attention to some glaciated boulders and briefly discusses their mode of transportation.

WRIGHT, G. Frederick. Notes on the glaciation of the Pacific coast.

Am. Naturalist, vol. 21, pp. 250-256. 1887.

Describes results of glaciation along Northern Pacific Railroad west from Bismarck, in the region about Puget Sound, and glaciers and evidence of glacial action up the coast. Discusses the glacial history of the Puget Sound region.

— The Muir glacier.

Am. Jour. Sci., 3d series, vol. 33, pp. 1-18. 1887.

WRIGHT, G. Frederick—Continued.

Sci. Am., Supt., vol. 23, pp. 9232-9234. No. 578. 1887.

Description of the glacier, its moraines, its motion, evidence of its retreat, associated drift and rock formations, striae, and buried forest and other glaciers in its vicinity.

— ["The ice age in North America."]

Am. Geologist, vol. 1, p. 68, $\frac{1}{2}$ p. 1838.

Notice of lecture to Lowell Institute. Reference to nature of evidence indicative of two glacial epochs.

— On the age of the Ohio gravel beds.

Boston Soc. Nat. Hist., Proc., vol. 23, pp. 427-436. 1888.

Extract, "Preglacial man in Ohio," Ohio Arch. and Hist. Quart. December, 1887.

Describes the relations of the Trenton gravels and of deposits of similar origin in the valley of the Little Miami in Ohio, and discusses the date of their deposition in glacial times.

— The ice age in North America, and its bearings upon the antiquity of man. 640 pages, maps. New York, 1889.

Abstract, Popular Science Monthly, vol. 35, pp. 557-560. 1889.

Review, W. M. Davis, Science, vol. 14, pp. 118-119. 1889; Appalachia, vol. 6, pp. 72-73. 1890.

I. What is a glacier? II. Existing glaciers on the Pacific coast. III. A month with the Muir glacier. IV. Glaciers of Greenland. V. Glaciers in other parts of the world. VI. Signs of glaciation. VII. Boundary of the glaciated area in North America. VIII. Depth of ice during the glacial period. IX. Terminal moraines. X. Glacial erosion and transportation. XI. Drumlins. XII. Preglacial drainage. XIII. Drainage during the glacial period. XIV. Kames. XV. Glacial dams, lakes, and waterfalls. XVI. The loess. XVII. Flight of plants and animals during the glacial period. XVIII. Europe during the glacial period. XIX. The cause of the glacial period. XX. The date of the glacial period. XXI-XXII. Man and the glacial period. Appendix: A. Probable causes of glaciation. B. Chalmers on the glaciation of eastern Canada.

— The age of the Philadelphia red gravel.

Boston Soc. Nat. Hist., Proc., vol. 24, pp. 152-157. 1889.

Discussion of the age and condition of deposition of the Columbia formation, and incidentally considers the origin of some high-level Columbia gravels in the Susquehanna valley.

— [Image from deep well at Nampa, Idaho.]

Am. Geologist, vol. 4, pp. 337-338. 1889.

WRIGHT, G. Frederick—Continued.

Includes record of 320-foot well and expression of opinions in regard to the age of the beds in which the image was found.

— The glacial boundary in southeastern Dakota. [Abstract.]

Am. Assoc. Adv. Sci., Proc., vol. 37, pp. 208-212. 1889.

An account of the glacial deposits, moraines, and topographic characteristics of the region, and discussion of its glacial history.

— Chipped implement in the drift, Jackson County, Illinois. See **CRESSON**, Hilborne T.

WYATT, Francis. The development of the American chemical industry.—Salt.

Eng. and Mining Jour., vol. 44, pp. 411, 432-433, 448-449. 1887.

Description of salt deposits and borings in Michigan and New York.

Wyoming, Brontops robustus from the Miocene, MARSH.

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Cretaceous, **WARD**.

geologic history of Yellowstone Park, **HAGUE**.

Wyoming—Continued.

leucite rock, Absaroka range, **HAGUE**.

Laramie, **WHITE, C. A.**

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oil fields, **RIGGS**.

Report of Geologist, **RICKETTS**.

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Tertiary, **COPE**.

upper Eocene lacustrine formations, **SCOTT**.

Yellowstone Park, **HAGUE**. **IDDINGS**. **TOULA**.

Wyoming, Report of Territorial Geologist for 1887, RICKETTS.**Z.**

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